



TITLE:

New Species and New Japanese Records of the Gammaridea (Crustacea : Amphipoda) from Matsukawa-ura Inlet, Fukushima Prefecture, Japan

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**New Species and New Japanese Records
of the Gammaridea (Crustacea: Amphipoda)
from Matsukawa-ura Inlet, Fukushima Prefecture, Japan**

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Abstract Nineteen species of gammaridean Amphipoda were collected by plankton net from Matsukawa-ura Inlet, Fukushima Prefecture, Japan, during an ecological survey of fish larvae. Six new species and three new records for Japan were found. *Pontogeneia stocki* Hirayama, 1990 has been reported as a new species previously. The other eight species are described and figured herein: *Atylus matsukawaensis* sp. nov., *Synchelidium longisegmentum* sp. nov., *Dulichia biarticulata* sp. nov., *Gitanopsis oozekii* sp. nov., *Stenothoe dentirama* sp. nov., *Lepidepcreum gurjanovae* Hurley, 1963, *Eogammarus possjeticus* Tzvetkova, 1967, and *Tiron spiniferus* (Stimpson, 1853).

Key words: Amphipoda, Gammaridea, Fukushima Prefecture

Introduction

The gammaridean amphipods are thought to be the dominant taxonomic group that comprise food items of fish larvae in coastal waters. Taxonomical and ecological studies of the gammaridean amphipods, thus, might contribute to the investigation of survival mechanisms of fish larvae. Dr. Y. Oozeki and his co-workers conducted an ecological survey of fish larvae with plankton nets at Matsukawa-ura Inlet, Fukushima Prefecture, Japan (37°46'–49'N, 140°57'–141°00'W), in 12 to 17 February 1989. During the study, they collected gammaridean amphipods together with the fish larvae and other invertebrates.

In this collection, we found 19 gammaridean species which contained 6 species new to science and 3 known species unrecorded in Japan. One of these new species, *Pontogeneia stocki* Hirayama, 1990, has been already reported in Hirayama (1990). We describe the other 8 species in the present paper: *Atylus matsukawaensis* sp. nov., *Eogammarus possjeticus* Tzvetkova, 1967, *Dulichia biarticulata* sp. nov., *Gitanopsis oozekii* sp. nov., *Lepidepcreum gurjanovae* Hurley, 1963, *Stenothoe dentirama* sp. nov., *Synchelidium*

longisegmentum sp. nov., and *Tiron spiniferus* (Stimpson, 1853).

The other gammaridean species collected are: *Allorchestes angusta* Dana, 1856, *Ampithoe lacertosa* Bate, 1858, *Aoroides columbiae* Walker, 1898, *Corophium acherusicum* Costa, 1857, *Erichthonius pugnax* (Dana, 1852), *Gammaropsis japonicus* (Nagata, 1961), *Guernea ezoensis* Ishimaru, 1987, *Jassa* sp. aff. *falcata* (Montagu, 1808), *Synchelidium lenorostratum* Hirayama, 1986, and *Melita shimizui* (Uéno, 1940).

Of the three species that had not been previously recorded in Japanese waters, *Eogammarus possjeticus* and *Tiron spiniferus* have been recorded in the North-West Pacific (Tzvetkova, 1967; Tzvetkova & Kudrjaschov, 1985; Gurjanova, 1951), and the latter species, especially, has shown a circum-boreal distribution (J. L. Barnard, 1972a; Lincoln, 1979). The other species, *Lepidepcreum gurjanovae*, has been collected from the west coast of North America (Hurley, 1963; J. L. Barnard, 1969). Morphological variation of the three species, however, has not been reported in detail to date, and our specimens slightly differ from their original and accumulative descriptions and figures. Thus, problems on their intraspecific morphological variation are discussed in the remarks section for each species. All specimens will be deposited at the Toyama Science Museum, Toyama, Japan.

Systematics

Family ATYLIDAE Liljeborg

Genus *Atylus* Leach

Atylus matsukawaensis sp. nov.

(Figs. 1–4)

Material examined

Holotype: male, 9.0 mm long, collected from Matsukawa-ura Inlet, Fukushima Prefecture, Japan, 12 February 1989, coll. Y. Oozeki and his co-workers. Paratypes: Nos. 1–5, male, 8.5 mm, 8.8 mm, 9.3 mm, 8.5 mm and 9.7 mm long and nos. 6–10, female, 12.5 mm, 7.6 mm, 10.8 mm, 10.1 mm and 9.0 mm long, collected together with the holotype. The holotype and a part of the paratype no. 6 are mounted on glass slides in gum-chloral medium. Collection number: Asia-5.

Etymology

The specific name, *matsukawaensis*, refers to the type locality of this species.

Description of holotype (male)

Body. 9.0 mm long. Not completely compressed, rather roundish dorsally; pereon and pleon not carinate; pleonal epimera 1–3 spinose ventrally, posterodistal angles rectangular, with spine. Keel on urosomite 1 as usual in atylids; urosomites 2–3 coalesced, keel not developed. Gills present on pereonites 2–7.

Antennae. Antenna 1 shorter than antenna 2; peduncular articles 1–2 finely crenulate and pubescent in rows ventrally, 11:12 in length ratio; accessory flagellum 1-articulate, very small, only with 2 apical setae; flagellum articles with tufts of aesthetascs ventro-distally. Antenna 2, gland cone of peduncular article 2 medium; peduncular articles 3–4 pubescent in transverse rows on throughout dorsal

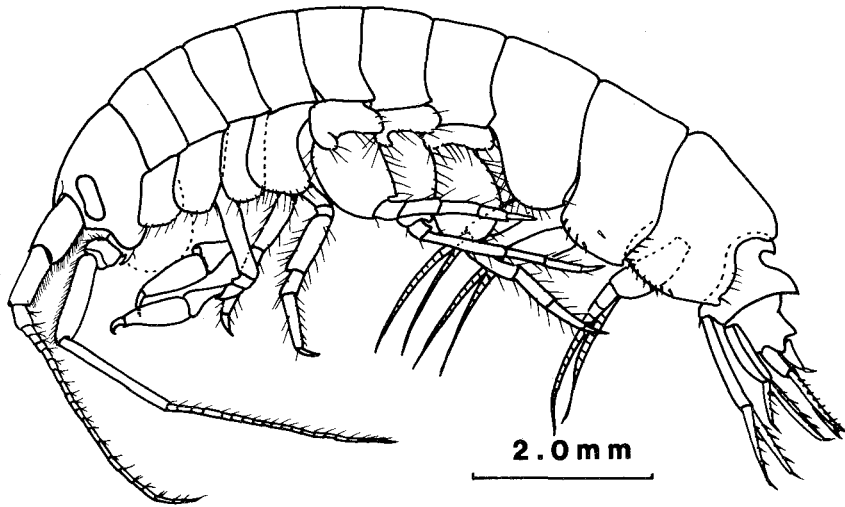


Fig. 1. *Atylus matsukawaensis* sp. nov. Holotype, male, 9.0 mm.

surface; length ratio of peduncular articles 4–5 7:10; flagellum articles with distal spine excluding five proximal and two distal articles.

Mouthparts. Upper lip as usual in the atylids. Lower lip lacking inner lobe, shoulders without row of stiff setae. Both mandibles similar; incisor 3-dentate; lacinia mobilis 5-dentate, accessory combed teeth 4 (right) and 5 (left); molar process developed, rugose marginally, ornamented with rasping disk upper-basally; palp rather slender, 3-articulate, ultimate article $\frac{3}{4}$ the length of penultimate article, with 12 pectinate setae progressively elongating. Inner plate of maxilla 1 with 5 plumose setae; outer plate with 2 rows of 6 and 5 serrate teeth; palp 2-articulate, ultimate article with 7 spatulate teeth and row of 4 submarginal setae along teeth. Inner plate of maxilla 2 smaller than outer plate, lacking facial setal row. Inner plate of maxilliped with 4 conical teeth and oblique facial row of plumose setae; outer plate with 15 teeth, distal one elongate and slender, and apical margin with 3 thick setae; palp 4-articulate, penultimate article ovate, setose on distal margin.

Gnathopods. Subchelate, similar except for gnathopod 1 being slightly smaller than gnathopod 2. Propodus distorted-ovate, spinose in single and rows medio-posteriorly; palm oblique, defined by rows of spines, with one small distal spine.

Pereopods. Pereopods 3–4 homopodous; coxa 3 subrectangular, slightly rounded anteriorly, coxa 4 slightly concave posteriorly; length ratio of articles from merus to dactyl approximately 10:4:7:3; propodus with pair of slightly hooked spines distally. Pereopods 5–7 similar except in length, and shapes of coxa and basis; pereopod 6 longer than pereopods 5 and 7; coxae 5–6 similar, with anterior lobe divided by deep notch, coxa 7 slightly concave ventro-medially; basis of pereopods 5–6 slightly expanded, not protruding postero-distally; basis of pereopod 7 remarkably winged, rounded posteriorly, posterodistal end protruding far beyond ischium.

Pleopods. Pleopod 1, rami ca. 1.5 times the peduncular length, proximal article of

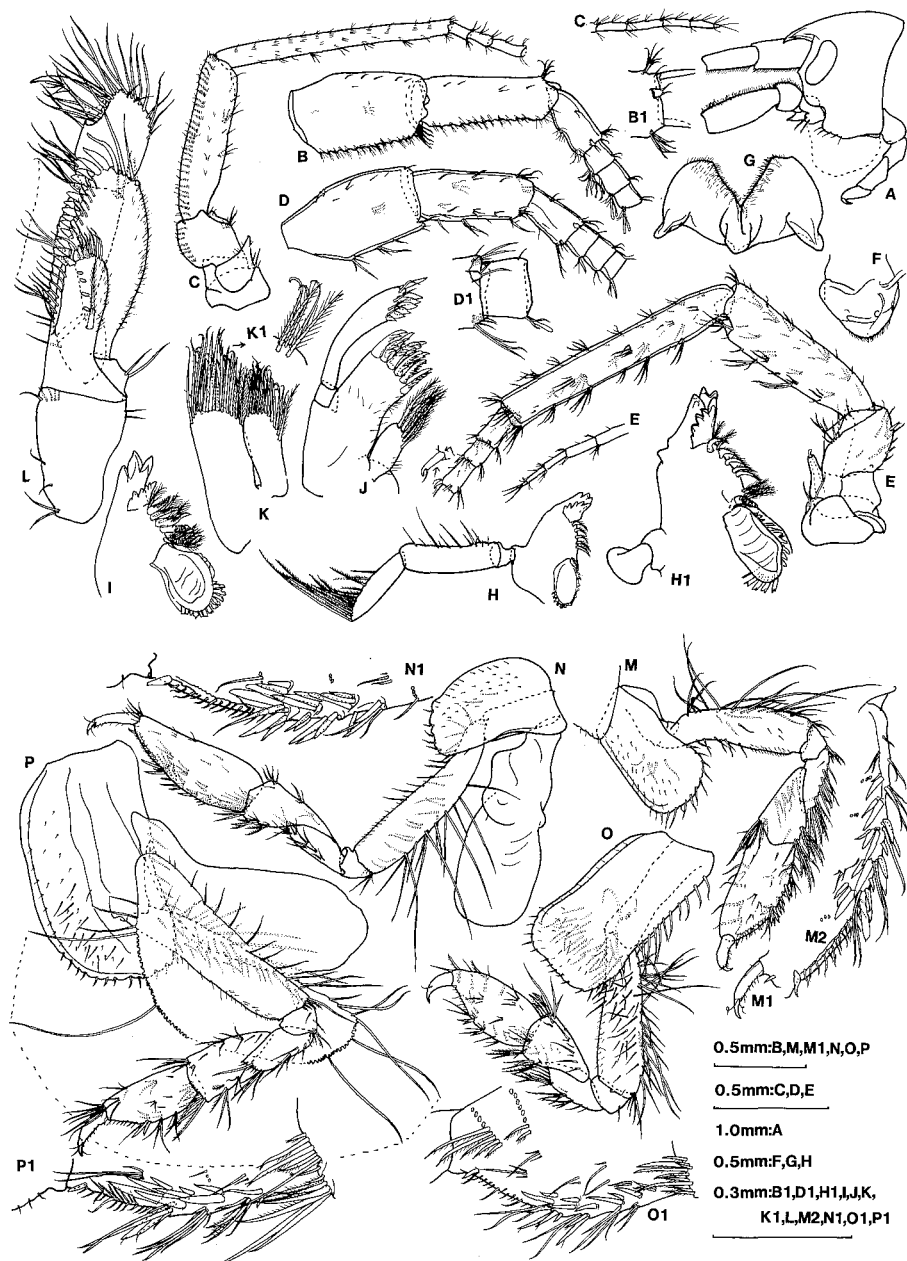


Fig. 2. *Atylus matsukawaensis* sp. nov. Holotype, male, 9.0 mm; A, B, B1, C, F, G, H, H1, I, J, K, K1, L, M, M1, M2, N, and N1. Paratype No. 6, female, 12.5 mm; D, D1, E, O, O1, P, and P1. A: Head. B: Male antenna 1. B1: Male accessory flagellum of antenna 1. C: Male antenna 2. D: Female antenna 1. D1: Female accessory flagellum of antenna 1. E: Female antenna 2. F: Upper lip. G: Lower lip. H and H1: Left mandible. I: Right mandible. J: Maxilla 1. K and K1: Maxilla 2. L: Maxilliped. M: Male gnathopod 1. M1 and M2: Dactyl and palm of male gnathopod 1. N: Male gnathopod 2. N1: palm of male gnathopod 2. O: Female gnathopod 1. O1: Palm of female gnathopod 1. P: Female gnathopod 2. P1: Palm of female gnathopod 2.

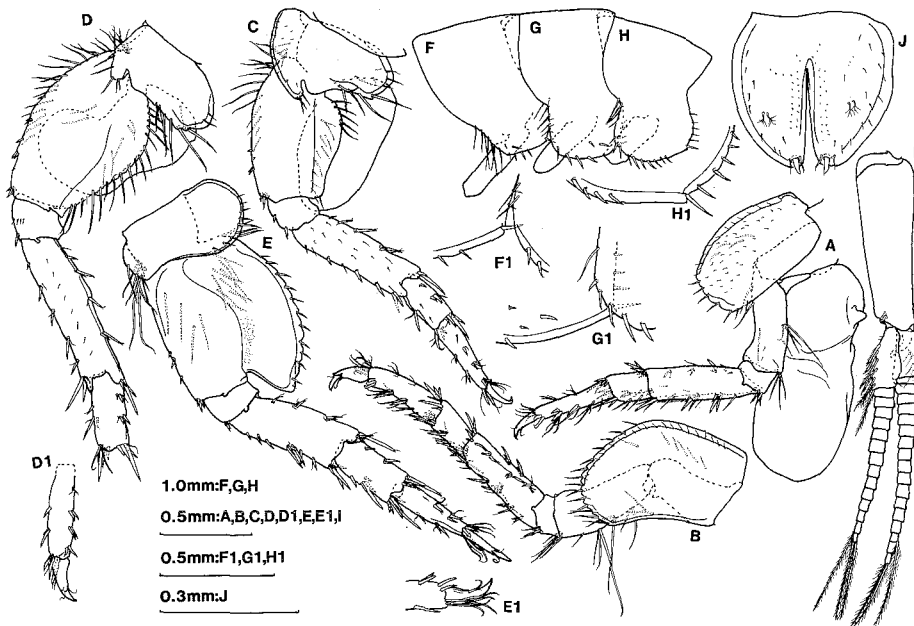


Fig. 3. *Atilus matsukawaensis* sp. nov. Holotype, male, 9.0 mm. A: Pereopod 3. B: Pereopod 4. C: Pereopod 5. D: Pereopod 6. D1: Propodus and dactyl of pereopod 6. E: Pereopod 7. E1: Dactyl of pereopod 7. F: Pleonite 1. F1: Pleonal epimera 1-2, G: Pleonite 2. G1: Pleonal epimera 2-3. H: Pleonite 3. H1: Pleonal epimeron 3. I: Pleopod 1. J: Telson.

inner ramus with 4 bifid and 3 usual pinnate setae; terminal swimming setae $1/3$ the ramus length.

Uropods. Uropod 1 slightly extending beyond uropod 3; peduncle as long as inner ramus, with 2 longitudinal rows of spines ventrally, and 5 dorso-lateral and 8 dorso-medial spines, latero-distal one stout; rami similar except for inner ramus a little shorter than outer ramus, truncate distally, with 4 and 5 apical spines respectively. Uropod 2, peduncle midway between the rami in length; rami truncate distally, with

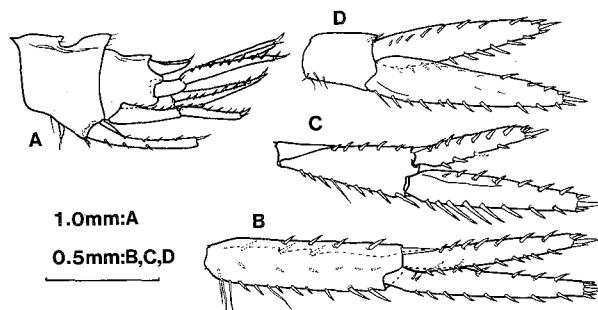


Fig. 4. *Atilus matsukawaensis* sp. nov. Holotype, male, 9.0 mm. A: Urosome. B: Uropod 1. C: Uropod 2. D: Uropod 3.

4 and 5 apical spines respectively, outer ramus about 1.6 times the length of inner ramus. Uropod 3, peduncle clearly shorter than 1/2 the length of outer ramus, with spine latero-distally; outer ramus shorter than inner ramus, rami leaf-formed, truncate distally, with 2 apical spines, spinose marginally.

Telson. Small, almost as long as wide, semiovate, cleft 2/3 of its length, each lobe with apical spine.

Description of female

Paratype no. 6, 12.5 mm long. Peduncles of antennae 1–2 not pubescent. Gnathopods 1–2 rather shortened than those of male.

Remarks

The present species has the following distinguishing characteristics: 1) the pereon and pleon are not carinate, rather roundish dorsally; 2) the basis of pereopod 5 does not remarkably protrude downward (see those of *Atylus brevitarsus* Ledoyer, 1979 and *A. glanurosus* (Walker, 1904) in Ledoyer (1982a)); 3) the carpus of pereopod 5 is prominently small and the elongate dactyl is enormously curved (see the counterpart of *A. falcatus* Metzgen, 1971 in Lincoln (1979), Chevreux & Fage (1925) and Sars (1985), and *A. uncinatus* Sars, 1882 in Sars (1882)); 4) the telson is almost as long as wide. A combination of these characteristics has been perceived only in *A. swammerdami* (Milne-Edwards, 1830) (Gurjanova, 1951; Bousfield, 1973; Ledoyer, 1982a). Lincoln (1979) stated that the pleonites 1–3 of *A. swammerdami* from the British Isles are weakly keeled dorsally. The present species, however, clearly differs from *A. swammerdami* as follows: 1) an accessory flagellum of antenna 1 is present in the present species but in *A. swammerdami* is absent; 2) in bases of pereopods 5–6, the hind lobes of the present species protrude less and are expanded less than those of *A. swammerdami*; 3) the telson of the present species is almost as long as wide and is semiovate, while that of *A. swammerdami* is a little longer than wide and is subrectangular.

In addition, the present species has 3-dentate incisors in both mandibles, while the incisor in all other species of the genus *Atylus* is 5- or 6-dentate so far as is known (Sars, 1895; Bulycheva, 1955; Mills, 1961; J. L. Barnard, 1970, 1972a, 1974; Sivaprakasam, 1970; Bellan-Santini, 1974; McKinney, 1980; Ledoyer, 1982a; Hirayama, 1986a; Moore, 1984).

Only one species of *Atylus* has been so far reported from North Japan: *A. occidentalis* Hirayama, 1986 from Otsuchi Bay facing the Pacific coast (Hirayama, 1986a). The present species is comparatively similar to this species in external appearance except for the following differences: 1) the body is not completely compressed; 2) the basis of pereopod 5 neither protrudes nor expands; 3) the telson is semiovate and almost as long as wide; 4) the propodi of the gnathopods of the present species are more spinose than those in *A. occidentalis*; 5) the accessory flagellum of the present species is ornamented with 2 setae, while it of the latter with 4 setae; 6) the present species lacks inner plates on the lower lip, while the inner plates are clearly present in the

lower lip of *A. occidentalis*; 7) the inner plates of the maxilliped in the present species have provided only 4 conical teeth, while that of *A. occidentalis* has one slightly elongate tooth in addition to the four conical teeth.

Family OEDICEROTIDAE Liljeborg

Genus *Synchelidium* Sars

***Synchelidium longisegmentum* sp. nov.**

(Figs. 5–7)

Material examined

Holotype: male, 6.0 mm long, collected from Matsukawa-ura Inlet, Fukushima Prefecture, Japan, 12 to 13 February 1989, coll. Y. Oozeki and his co-workers. Paratypes: Nos. 1–7, female, 4.6 mm, 4.0 mm, 2.8 mm, 3.2 mm, 3.0 mm, 2.8 mm and 4.4 mm long, collected together with the holotype. The holotype and a part of the paratype no. 1 are mounted on glass slides in gum-chloral medium. Collection number: Asia-6.

Etymology

The species name, *longisegmentum*, refers to the elongate flagellum article 1 of male antenna 1 of the new species.

Description of holotype (male)

Body. 6.0 mm long. Rostrum gently curved, never abruptly directed downward apically, slightly extending beyond peduncular article 1 of antenna 1. Eyes large. Posterior and ventral margins of pleonal epimeron 2 gently rounded. Gills present on pereonites 2–6.

Antennae. Antenna 1 almost as long as peduncle of antenna 2; peduncular article 3 shorter than 1/2 the length of peduncular article 2; flagellum article 1 4/5 the length of peduncular articles 1–2 together. Antenna 2 longer than body length, gland cone rather small, length ratio between peduncular articles 4–5 3:5.

Mouthparts. Outer plates of lower lip with gland cone on shoulders. Both mandibles similar except for lacinia mobilis; lacinia mobilis bifid in right mandible and 5-dentate in left mandible, accessory spines 3; molar process small, with 2 spines, one of them pinnate, the other pectinate distally; palp 3-articulate, elongate, ultimate article shorter than penultimate article, armed with comb-like row of setae on medial face from near base to apex. Maxilla 1, inner plate with pinnate seta; outer plate with 9 teeth; palp 2-articulate, with setae and 1 thick and 2 slender spines apically. Maxilla 2 not densely setose, both plates about equal in size. Maxilliped, inner plate small, with 7 short setae apically; outer plate with 16 rather slender teeth on medial margin; penultimate article of palp clearly protruding latero-distally.

Gnathopods. Gnathopod 1 subchelate; merus slightly protruding postero-distally; carpal lobe exceeding hind margin of propodus, with 2 slender and thick spines apically; propodus ovate, palm oblique, reaching middle point of propodal length, defined by finely pectinate spine. Gnathopod 2 chelate; amalgamate complex of carpus and propodus longer than basis, distal protrusion never coalesced throughout; dactyl

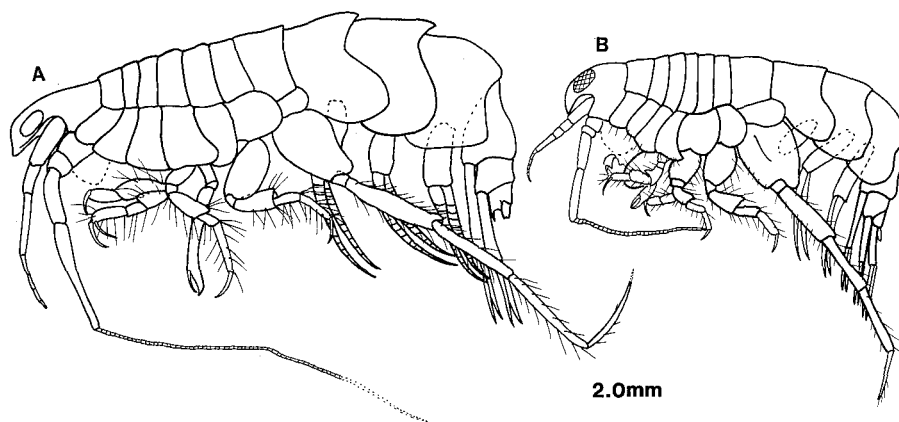


Fig. 5. *Synchelidium longisegmentum* sp. nov. A, Holotype, male, 6.0 mm. B, Paratype no. 1, female, 4.6 mm.

ca. $1/4$ the propodal length.

Pereopods. Pereopods 3–4 homopodous except for coxae; coxa 3 anterodistally expanded, coxa 4 deeper than wide; antero-distal oblique margin of basis setose in row; merus gradually expanding forward; carpus and propodus equal in length; dactyl 0.7 times the propodal length. Pereopods 5–6 homopodous except for coxa 5 smaller than coxa 6; hind lobe of basis rather slender; merus gradually expanding forward; length ratio of articles from carpus to dactyl almost 10:13:10; dactyl hooded apically. Pereopod 7 remarkably elongate; hind lobe of basis rather slender, extending beyond ischium; length ratio of articles from merus to dactyl 8:8:9:9; dactyl styliiform.

Pleopods. Similar, rami shorter than twice the peduncular length; terminal swimming setae shorter than $1/2$ the ramus length.

Uropods. Uropod 1 not reaching apex of uropod 2, peduncle longer than rami; rami lanceolate, inner ramus slightly longer than outer ramus. Uropod 2, peduncle shorter than outer ramus; rami lanceolate, outer ramus shorter than inner ramus. Uropod 3 missing (see description in female).

Telson. Ovate, finely emarginate.

Description of female

Paratype no. 1, 4.6 mm long. Rostrum galeate, less prolonged than in the male. Antenna 1, length ratio of peduncular articles 1–3 and flagellum article 1 7:5:3:7; flagellum article 1 prominently elongate. Antenna 2 shorter than body length; peduncular articles 4–5 5:7 in length ratio. Gnathopods 1–2, uropods 1–2 and telson similar to those of male respectively. Uropod 3 extending far beyond uropod 2, peduncle ca. $3/5$ as long as inner ramus, rami lanceolate.

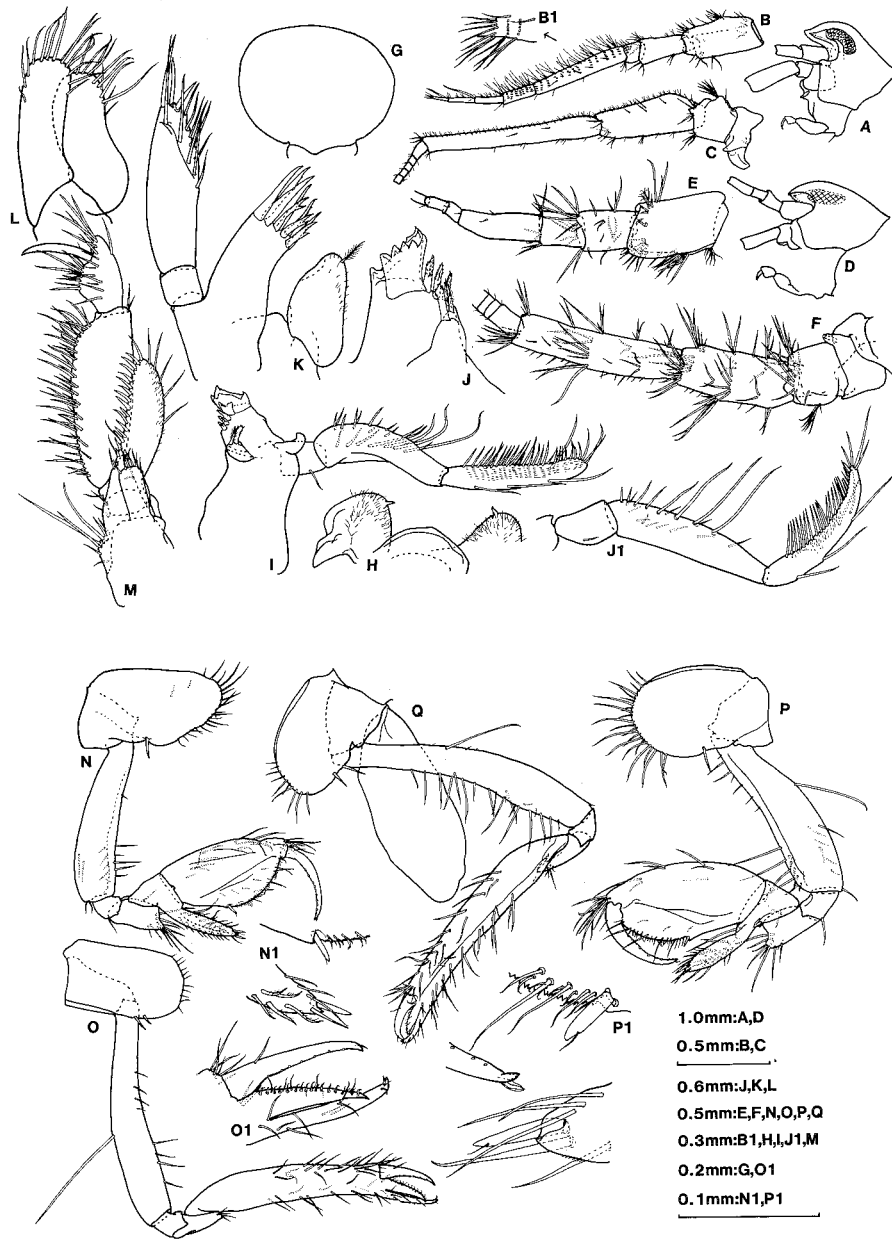


Fig. 6. *Synchelidium longisegmentum* sp. nov. Holotype, male, 6.0 mm; A, B, B1, C, G, H, I, J, J1, K, L, M, N, N1, O and O1. Paratype no. 1, female, 4.6 mm; D, E, F, P, P1 and Q. A: Male head. B: Male antenna 1. B1: Setal rows of flagellum segment 1 in male antenna 1. C: Male antenna 2. D: Female head. E: Female antenna 1. F: Female antenna 2. G: Upper lip. H: Lower lip. I: Right mandible. J: Left mandible. J1: Palp of left mandible. K: Maxilla 1. L: Maxilla 2. M: Maxilliped. N: Male gnathopod 1. N1: Carpal lobe and a defining spine of propodus in male gnathopod 1. O: Male gnathopod 1. O1: Dactyl and propodus in male gnathopod 2. P: Female gnathopod 1. P1: Carpal lobe, defining spine of propodus, and dactyl in female gnathopod 1. Q: Female gnathopod 2.

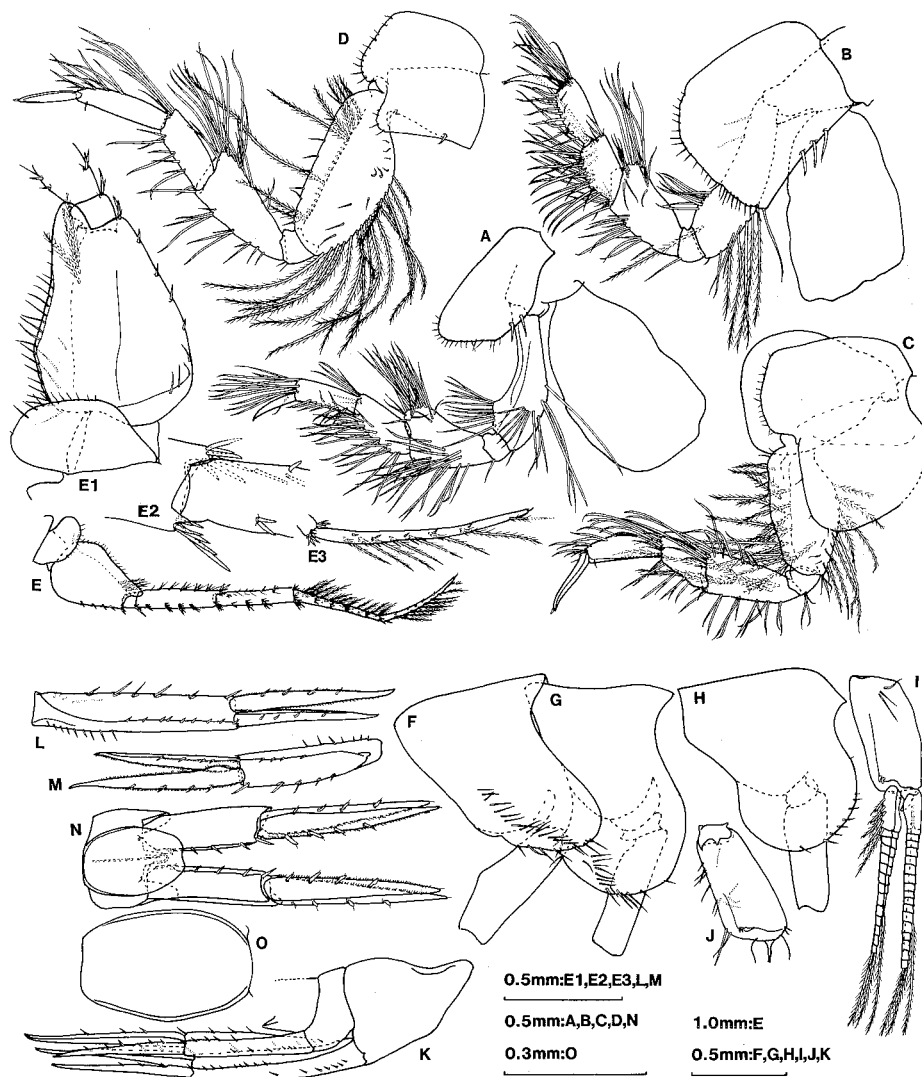


Fig. 7. *Synchelidium longisegmentum* sp. nov. Holotype, male, 9.0 mm; A, B, C, D, E, E1, E2, E3, F, G, H, I, J, K and O. Paratype no. 1, female 4.6 mm; L, M, N. A: Pereopod 3. B: Pereopod 4. C: Pereopod 5. D: Pereopod 6. E: Pereopod 7. E1, E2, and E3: Basis, merus and carpus, and dactyl in pereopod 7. F: Pleonite 1. G: Pleonite 2. H: Pleonite 3. I: Pleopod 1. J: Peduncle of pleopod 3. K: Urosome. L: Uropod 1. M: Uropod 2. N: Uropod 3 and telson. O: Telson.

Remarks

In the present species, the palm of gnathopod 1 is strongly oblique and the carpal lobe does not reach the tip of the propodus. Further, the dactyli of pereopods 3–4 are long and attain more than half the length of the propodus. A combination of these characteristics is observed in *Synchelidium longidigratum* Ruffo, 1947 from the Mediterranean Sea (see also Ledoyer, 1982b), *S. carinirostrum* Jo, 1990 from Korea (Jo,

1990), *S. rostriopiculum* Hirayama, 1987 from Japan (Hirayama, 1987), *S. lenorostralum* Hirayama, 1986 from Japan and Korea (Hirayama, 1986b; Jo, 1990), and *S. miraculum* Imbach, 1967 from Viet-Nam (Imbach, 1967); *S. lenorostralum* was raised from the subspecies *S. miraculum lenorostralum* Hirayama, 1986 by Jo (1990). Among them, the Asian species including the present species are clearly distinguished from the Mediterranean species by the broad meri of pereopods 3–6 and the broad hind lobe on the basis of pereopod 7. Further, males of the Asian species, except for *S. rostriopiculum*, of which males have not been known to date, has antenna 1 with reduced peduncular article 1 and remarkably elongate flagellum article 1.

The present species is clearly distinguished from these four Asian species by the flagellum article 1 almost twice as long as the peduncular article 3 in female. In the other species, the flagellum article 1 is shorter than the peduncular article 3. Moreover, additional distinguishable characters of the present species from the other Asian species are listed below.

In *S. carinirostrum*, the dactyl of gnathopod 2 is almost a quarter the length of the amalgamate complex of carpus and propodus in both sexes (in the present species almost one-fifth) and the dactyli of pereopods 3–4 are longer than the propodus (in the present species shorter).

In *S. lenorostralum*, the merus of gnathopod 1 protrudes postero-distally more than does that of the present species; article 3 of the maxilliped palp does not protrude latero-distally (in the present species protruding); the ultimate article of the mandibular palp is ornamented with a comb-like row of setae on almost half its medial length (in the present species on the greater part of the medial face); the pleonal epimeron 2 is angulate postero-ventrally (in the present species gently round); the telson is clearly emarginate (in the present species hardly emarginate).

In *S. rostriopiculum*, the rostrum is not deflected (in the present species gently curved downward); the ultimate article of the mandibular palp is ornamented with a comb-like row of setae on almost half the medial length as in *S. lenorostralum* (in the present species on the greater part of the medial face); the distal protrusions of the amalgamate complex of the carpus and propodus in the gnathopod 2 are completely coalescent (in the present species not coalescent distally); the coxa 4 is as deep as wide (in the present species clearly deeper than wide).

In *S. miraculum*, the rostrum is deflected perpendicularly (in the present species gently curved downward); the peduncular article 2 of the female antenna 1 is prominently elongate (in the present species usually short); the peduncular article 5 of the male antenna 1 is 1.4 times as long as the peduncular article 4 (in the present species 1.7 times); the uropods are less spinose than those of the present species.

Family LYSIANASSIDAE Dana

Genus *Lepidepecreum* Bate & Westwood***Lepidepecreum gurjanovae* Hurley, 1963**

(Figs. 8–11)

Lepidepecreum gurjanovae Hurley, 1963, pp. 49–53; J. L. Barnard, 1969, pp. 173–175.*Material examined*

One male, 12.6 mm long, and 10 young specimens (nos. 1–10, 3.1 to 4.5 mm long), collected from Matsukawa-ura Inlet, Fukushima Prefecture, Japan, 12 to 13 February 1989, coll. Y. Oozeki and his co-workers. The male and the juvenile specimen no. 1 are mounted on glass slides in gum-chloral medium. Collection number: Asia -7 (male) and -8 (juvenile).

Description of male

Body. 12.6 mm long. Not carinate on pereon and pleon; pleonite 3 extending backward dorsally; epimeron 3 not right-angled posteriorly. Dorsal keel on urosomite 1 not upturned, rounded posteriorly. Gills present on pereonites 2–6.

Antennae. Antenna 1, dorsal extension of peduncular article 1 reaching mid-point of following article; accessory flagellum 4-articulate, extending beyond flagellum article 1; flagellum article 1 shorter than 1/2 the dorsal length of peduncular article 1. Antenna 2 shorter than body length; gland cone rather small; peduncular articles 3–5 subequal in length.

Mouthparts. Upper lip as usual in the genus *Lepidepecreum*. Lower lip bending inward, rather slender, mandibular processes well developed. Both mandibles similar except for lacinia mobilis; lacinia mobilis in left mandible tooth-like, in right mandible absent, accessory spines 3; palp arising near base, length ratio of penultimate article to ultimate one 11:6, penultimate article with row of 14 setae on the distal third of the medial margin. Maxilla 1, inner plate with 2 pinnate setae apically; outer plate with 11 teeth apically; palp 2-articulate, with 7 conical teeth and pinnate seta apically. Maxilla 2, outer plate with row of 6 pectinate thick setae. Maxilliped, inner plate with 2 conical and 1 cord-like teeth apically; outer plate with about 16 conical teeth and basal spine on medial margin, and row of 6 small setae along row of conical teeth; palp slender, dactyl with nail-like spine, finely setose distally.

Gnathopods. Gnathopod 1 subchelate; basis 1/2 as long as gnathopod 1 excluding dactyl; propodus as long as carpus, palm small, oblique, convex, lacking 2 small protrusions (denticles), but with 2 palmar defining spines. Gnathopod 2 minutely chelate; ischium 2/5 the length of basis; carpus longer than ischium, distal half almost uniform in width, palm extending along longitudinal axis of propodus; dactyl reaching apex of palm when closed; palm and dactyl lacking spines and teeth.

Pereopods. Pereopods 3–4 homopodous except for coxae; coxa 4 L-formed, expanding backward on lower 7/12 part of depth; merus, carpus and propodus subequal in length, propodus with pair of hooked spines distally. Pereopods 5–7 similar in form except for coxae and basis, locking spines of propodus not hooked;

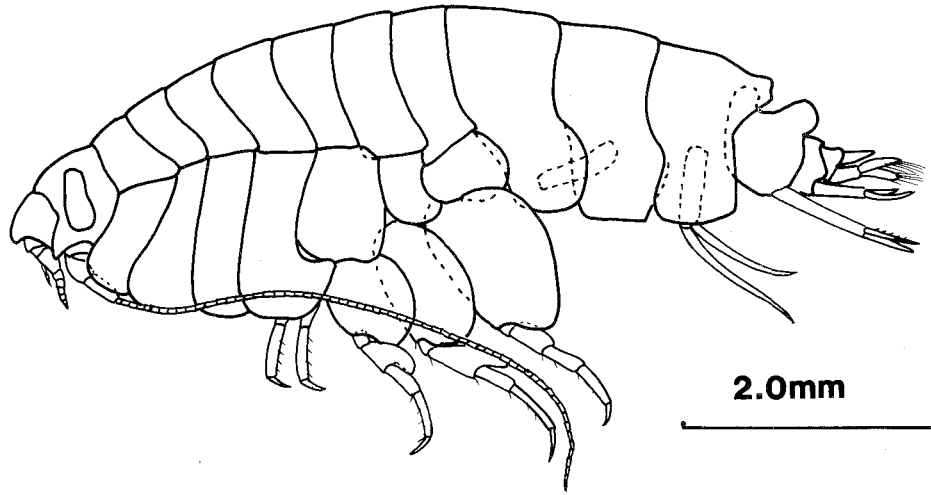


Fig. 8. *Lepideporeum gurjanovae* Hurley, 1963. Male, 12.6 mm.

coxa 5 almost as deep as wide; hind lobe of both bases ventrally smooth: basis of pereopod 5 rounded.

Pleopods. Similar; terminal swimming setae shorter than $1/2$ the ramus length.

Uropods. Uropod 1 extending beyond uropod 3; peduncle with many spines on both lateral and medial margins; rami with inset spine at apex, outer ramus $1/4$ as long as the peduncle, longer than inner ramus. Uropod 2, rami almost $1/4$ as long as the peduncle, with inset spine at apex. Uropod 3, rami foliaceous, with pinnate setae on medial and lateral margins; outer ramus longer than inner ramus, 2-articulate, terminal article spine-like.

Telson. Deeply cleft, hairy, lobes with longitudinal row of 10 or 11 spines.

Description of juvenile

Juvenile specimen no. 1, 4.5 mm long; remarkably differing from adult male in antenna 1, uropod 3 and telson. Peduncular article 1 of antenna 1 not prominently extending forward dorsally; flagellum article 1 not well developed. Uropod 3, rami lacking plumose setae; outer ramus not hairy, proportion of ultimate article to proximal one larger than in the adult. Telson cleft to point of $1/2$ the length, less spinose, not hairy, cleavage between lobes narrow.

Remarks

Lepideporeum gurjanovae Hurley, 1963 has been recorded from southern California (33°N) to British Columbia (55°N), the northeastern Pacific in depth of 3 to 1720 m (Hurley, 1963; J. L. Barnard, 1969) and shows morphological variation as pointed out by J. L. Barnard (1969).

The present male specimen well agrees with the original description and figures of this species based on a female type specimen (Hurley, 1963) except for uropod 3, antennae and telson, which show sexual dimorphism in the genus *Lepideporeum*. However, there are the following morphological differences between the type specimen



Fig. 9. *Lepidepecreum gurbanovae* Hurley, 1963. Male, 12.6 mm. A: Head. B: Antenna 1. C: Antenna 2. D: Upper lip. D1: Upper lip in ventral view. E: Lower lip. F and F1: Right mandible. G: Left mandible. G1: Article 1 of palp in left mandible. H: Maxilla 1. I: Maxilla 2. I1: Distal part of maxilla 2. J: Maxilliped. K: Gnathopod 1. K1: Propodus and dactyl of gnathopod 1. L: Gnathopod 2. L1: Propodus and dactyl of gnathopod 2. M: Pereopod 3. M1: Locking spines of left pereopod 1. M2: Locking spines of right pereopod 3. N: Pereopod 4. N1: Dactyl of pereopod 4. O: Pereopod 5. P: Pereopod 6.

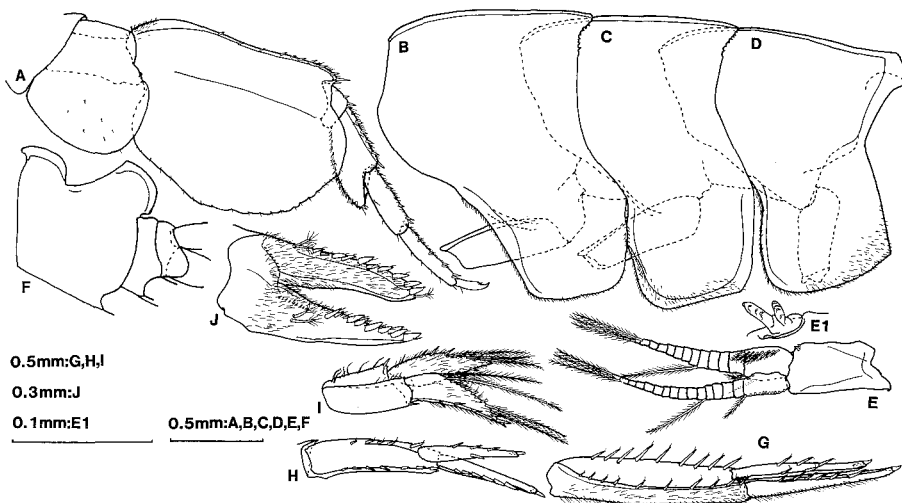


Fig. 10. *Lepidepcreum gurjanovae* Hurley, 1963. Male, 12.6 mm. A: Pereopod 7. B: Pleonite 1. C: Pleonite 2. D: Pleonite 3. E: Pleopod 3. E1: Coupling spines of pleopod 3. F: Urosome. G: Uropod 1. H: Uropod 2. I: Uropod 3. J: Telson.

and the present male specimen: 1) in the maxilliped, the inner plate with 3 conical teeth apically (in the present specimen with 2 conical teeth), the dactyl of palp finely serrate medio-distally (not serrate but finely setose in the present specimen); 2) the palm of gnathopod 1 ornamented with 2 minute protrusions (denticles) near the palmar defining spines (in the present specimen lacking them); 3) the dactyl of gnathopod 2 not reaching the end of the palm, the palm transverse (in the present specimen reaching the end of acuminate palm); 4) dorsal keel on urosomite 1 upturned, triangular (in the present specimen less risen, forming a quarter circle on the posterior margin); 5) postero-ventral corner of the epimeron 3 almost right-angled (in the present specimen not acute). Of these differences, the former two, especially the second (see J. L. Barnard's (1969) figure), are perhaps important in discriminating the Japanese or Asian population from the northwest American population in this species. We think that these show intraspecific differences, not interspecific ones. The others are seeming due to individual variation.

J. L. Barnard (1969) has pointed out the morphological variations of *Lepidepcreum gurjanovae* in comparing his shallow water (3 m) and continental shelf (15 to 135 m) specimens with Hurley's deep water (1720 m) specimen. However, in the third difference mentioned above, the palm of gnathopod 2 in J. L. Barnard's specimens is acuminate and its dactyl almost reaches the end of the palm in his figure. The gnathopod 2 of the present specimen rightly shows these characteristics. In the 4th item, the dorsal keel in J. L. Barnard's is less risen as in the present specimen. In the 5th item, the postero-ventral corner of pleonal epimeron 3 is not right-angled and is rather blunt as is in the present specimen. On the other hand, the present specimen differs from J. L. Barnard's in pereopods 5-7: the bases of J. L. Barnard's

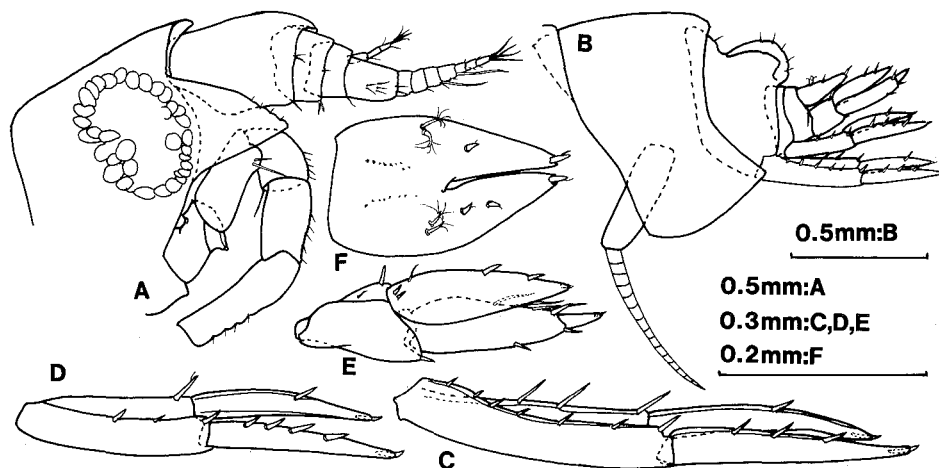


Fig. 11. *Lepidepcreum gurjanovae* Hurley, 1963. Juvenile specimen (no. 1), 4.5 mm. A: Head. B: Urosome. C: Uropod 1. D: Uropod 2. E: Uropod 3. F: Telson.

are strongly serrated postero-ventrally, while the counterpart of the present specimen as well as of Hurley's (1963) is smooth. Moreover, the male uropod 3 and the locking spines of pereopods 3–4 in the present specimen, these characteristics which are unclear in Hurley (1963), are similar to those of J. L. Barnard's (1969).

Family ANISOGAMMARIDAE Bousfield

Genus *Eogammarus* Birstein

***Eogammarus possjeticus* Tzvetkova, 1967**

(Figs. 12–14)

Eogammarus possjeticus Tzvetkova, 1967, pp. 176–181; Tzvetkova, 1975, pp. 109–114.

Material examined

One female, 9.2 mm long, collected from Matsukawa-ura Inlet, Fukushima Prefecture, Japan, 12 February 1989, coll. Y. Oozeki and his co-workers. This specimen is mounted on glass slides in gum-chloral medium. Collection number: Asia-9.

Description of female

Body. 9.2 mm long. Eyes ovate, medium in gammarids. Dorsal surface of pereon and pleon not armatured; pleonal epimeron 1 with minute tooth and minute spine postero-ventrally, pleonal epimera 2–3 extending backward postero-ventrally, with several spines ventally; groups of dorsal spines on urosomites 1–3 and the spine formulae being 1–3–3–2, 3–3 and 3–3–2, respectively. Gills present on pereonites 2–7; accessory blades double on pereonites 2–5, treble on pereonite 6, single on pereonite 7.

Antennae. Antenna 1 longer than antenna 2, peduncular articles 1–3 12:7:4 in

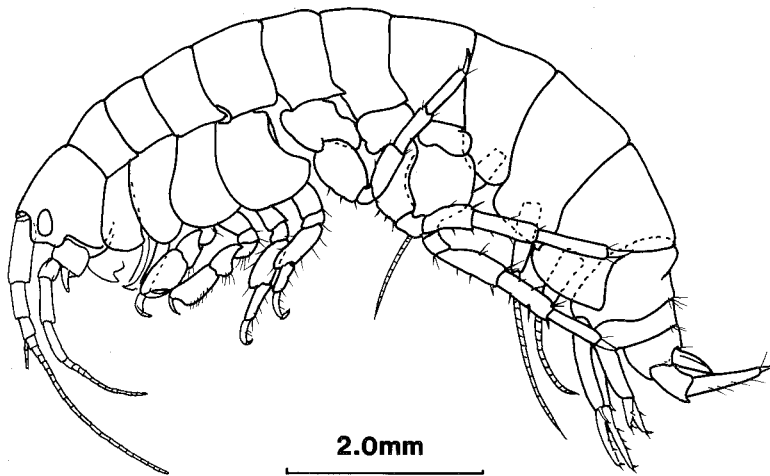


Fig. 12. *Eogammarus possjeticus* Tzvetkova, 1967. Female, 9.2 mm.

length ratio, peduncular article 1 with postero-ventral pair of stiff setae instead of single spine; accessory flagellum 4-articulate. Antenna 2, gland cone of peduncular article 2 developed, extending nearly to distal end of following article, peduncular articles 4–5 equal in length; flagellum equal to or a little longer than peduncular articles 4–5 together.

Mouthparts. Upper and lower lips as usual in the genus *Eogammarus*, medial margin of outer lobes in lower lip with row of semi-thick, short setae. Both mandibles similar except for lacinia mobilis and number of accessory blades; incisor 5-dentate; lacinia mobilis not dentate in right mandible and 4-dentate in left mandible, accessory blades 5 (right) and 6 (left); palp 3-articulate, length ratio of penultimate article to ultimate 8:7, penultimate article with subdistal row of 5 stiff long setae, ultimate article with row of short setae on distal half. Maxilla 1, inner plate with 13 marginal pinnate setae and distal row of stiff short setae; outer plate with 11 comb-like, furcate, and simple tooth-like spines; palp 2-articulate, ultimate article with 5 apical wedge-shaped teeth, apical seta and distal oblique row of 3 setae. Both inner and outer plates of maxilla 2 similar in size and form, inner plate with facial row of 13 pinnate setae. Maxilliped, inner plate with 3 apical conical teeth and subdistal set of 2 finely serrate teeth; outer plate with medial row of 11 conical teeth, and 3 apical pinnate teeth, these teeth gradually elongating; palp 4-articulate, penultimate article with longitudinal row of 3 thick pectinate setae dorso-distally.

Gnathopods. Subchelate, dissimilar, gnathopod 1, propodus roundish, palm oblique, defined by row of 3 spines, else with row of 4 spines, these spines simple. Gnathopod 2, more slender than gnathopod 1; propodus equal to carpus in length, almost rectangular, palm transverse, with 2 rows of 4 non-pinnate and 5 pinnate

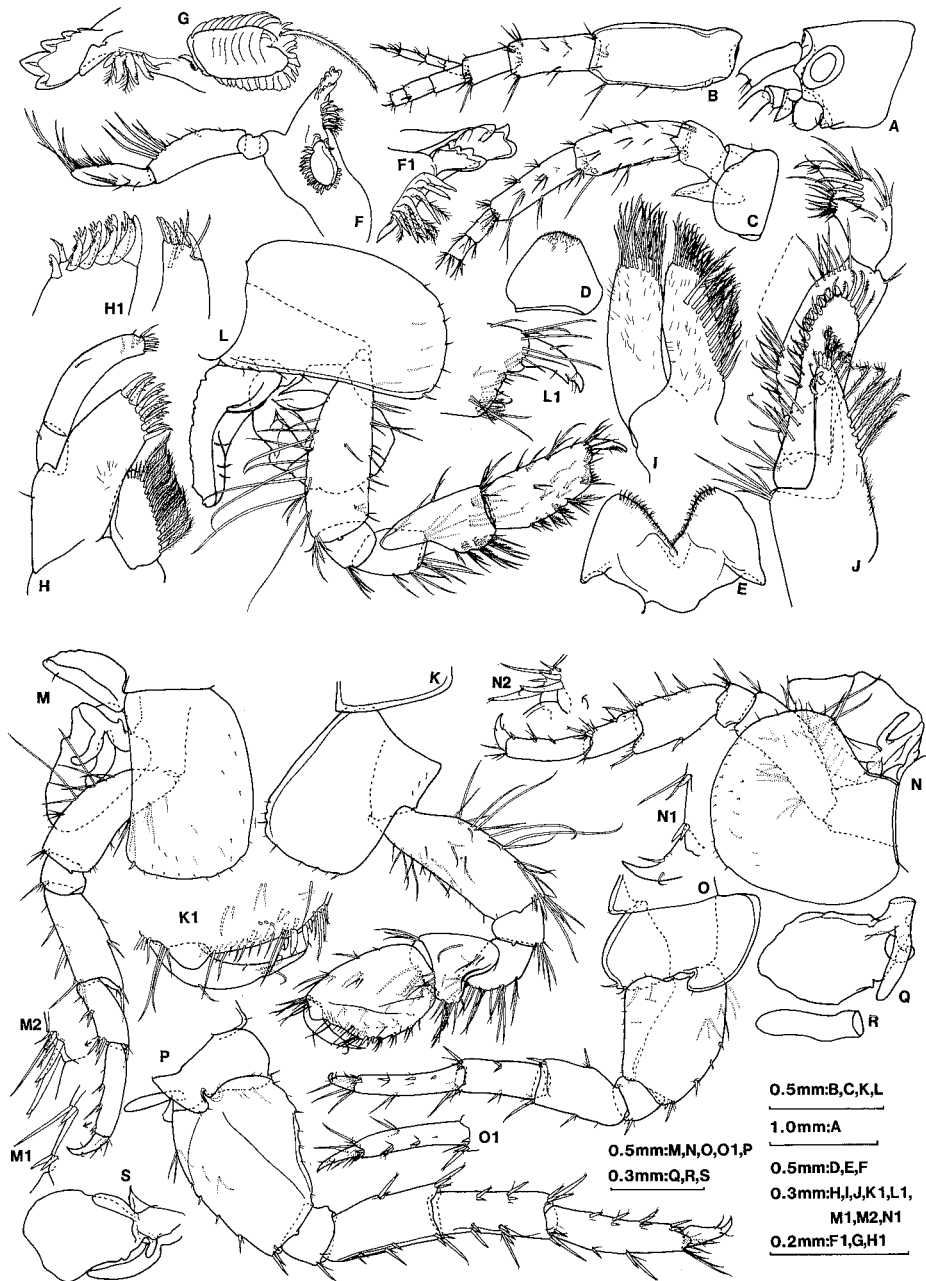


Fig. 13. *Eogammarus possjeticus* Tzvetkova, 1967. Female, 9.2 mm. A: Head. B: Antenna 1. C: Antenna 2. D: Upper lip. E: Lower lip. F and F1: Left mandible. G: Right mandible. H: Maxilla 1. H1: Outer plate and palp of maxilla 1. I: Maxilla 2. J: Maxilliped. K: Gnathopod 1. K1: Dactyl of gnathopod 1. L: Gnathopod 2. L1: Dactyl of gnathopod 2. M: Pereopod 3. M1 and M2: Carpus and propodus of pereopod 3. N: Pereopod 4. N1 and N2: Dactyl and carpus of pereopod 4. O: Pereopod 5. O1: Propodus and dactyl of pereopod 5. P: Pereopod 6. Q: Gill on pereonite 5. R: Oostegite on pereonite 5. S: Gill on pereonite 6.

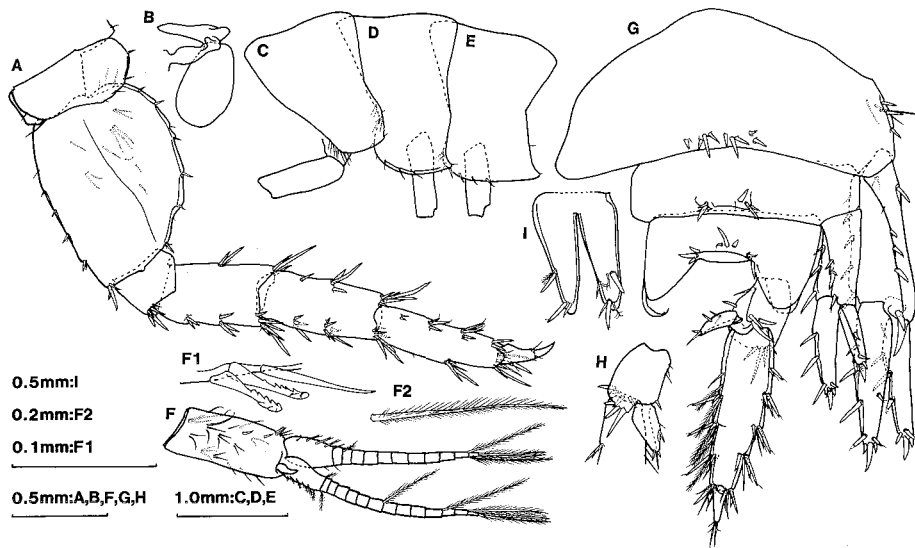


Fig. 14. *Eogammarus possjeticus* Tzvetkova, 1967. Female, 9.2 mm. A: Pereopod 7. B: Gill on pereonite 7. C: Pleonite 1. D: Pleonite 2. E: Pleonite 3. F: Pleopod 3. F1 and F2: Coupling spines and swimming seta in pleopod 3. G: Urosome. H: Uropod 3. I: Telson.

spines at palmar corner.

Pereopods. Pereopods 3–4 homopodous except for coxae; coxa 3 subrectangular, with spine postero-ventrally, coxa 4 broad, posterior concavity shallow; carpi with marginal row of unequal spines and setae postero-distally; propodi shorter than meri, with pair of locking spines; grasping margin of dactyli with seta medially. Pereopod 5, coxa bilobate, posterior lobe with 4 setae ventrally; hind lobe of basis slender, most expanding basally. Pereopods 6–7 similar in shape from ischium to dactyl; coxa 7 broad, slightly concave ventrally; hind lobe of basis in pereopod 6 remarkably expanding basally, gradually decreasing distally in width, in pereopod 7 gently rounded.

Pleopods. Pair of coupling spines following 1 or 2 setae; swimming setae having expanded base.

Uropods. Peduncle of uropod 1 with pair of latero-distal spines, one of them large: uropods 1–2, inner ramus subequal to peduncle in length, with distal pair of spines and apical set of 3 spines, outer ramus shorter and more slender than inner ramus, with distal pair of spines and apical set of 2 spines. Uropod 3 extending far beyond uropod 1: peduncle short, with latero-distal set of 3 spines and latero-ventral row of 4 spines; inner ramus scale-like, with middle spine and apical set of 2 spines and seta; outer ramus 2-articulate, basal article spinose marginally, intermixed with pinnate setae along medial margin, distal article only with several short apical setae.

Telson. Cleft nearly to basal 1/5 its length, each lobe rounded apically, with 1 lateral and 2 apical spines.

Remarks

The present species, *Eogammarus possjeticus* Tzvetkova, 1967, has been recorded from the Possjet Bay in the Sea of Japan, the south Sakhaline, and Kurile Islands (Tzvetkova, 1967; Tzvetkova & Kudrjaschov, 1985), but its morphological variations have not been known in detail.

The present specimen, female, triflingly differs from Tzvetkova's holotype of male (Tzvetkova, 1967, 1975) in articulate number of the accessory flagellum of antenna 1, mouthparts and spine formulae on urosomites 1–3. The gnathopods, which show sexual dimorphism in the genus *Eogammarus* (Bousfield, 1979), are also similar in both the present specimen and Tzvetkova's female specimen (paratype ?) (Tzvetkova, 1967, 1975). In the maxilla 1, the inner plate of the holotype has 16 apical pinnate setae, the outer plate 6 or 7 comb-like spines, and the palp 8 spines and a seta apically. On the other hand, in the maxilla 1 of the present specimen, the inner plate has 13 pinnate setae and an apical row of 4 stiff setae, the outer plate is provided with 11 comb-like, furcate and simple spines, and the palp is armed with 5 spines, an apical seta and one distal oblique row of 3 setae. Both mandibles are ornamented with 4 accessory teeth in the holotype but in the present specimen with 5 (right mandible) and 6 (left mandible) accessory teeth. Moreover, the spine formulae in the urosomites 1–3 of the holotype are 1–3(4)–1, 3(4)–3(4), and 3–1–3, but in the present specimen 1–3–3–2, 3–3 and 3–2–2.

Family PODOCERIDAE Leach

Subfamily DULICHIINAE Laubitz

Genus *Dulichia* Kroyer***Dulichia biarticulata* sp. nov.**

(Figs. 15–16)

Material examined

Holotype: male, 4.9 mm long, collected from Matsukawa-ura Inlet, Fukushima Prefecture, Japan, 13 February 1989, coll. Y. Oozeki and his co-workers. The holotype is mounted on glass slides in gum-chloral medium. Collection number: Asia-10.

Etymology

The specific name, *biarticulata*, refers to the biarticulate accessory flagellum of the present species.

Description of holotype (male)

Body. 4.9 mm long, cylindrical, slender. Head with visor. Eyes large, rounded. Dorsal length ratio among head, pereonites 1–5 and complex of coalescent pereonites 6–7 45:20:25:27:31:27:55. Coxae regressed, not overlapping. Pleon lacking epimera. Urosomite 1 elongate, cylindrical; urosomite 3 vestigial, concealed under telson, only with 2 distal setae opposed to each other. Gills present on pereonites 2–5.

Antennae. Antenna 1 shorter than body length; length ratio of peduncular articles

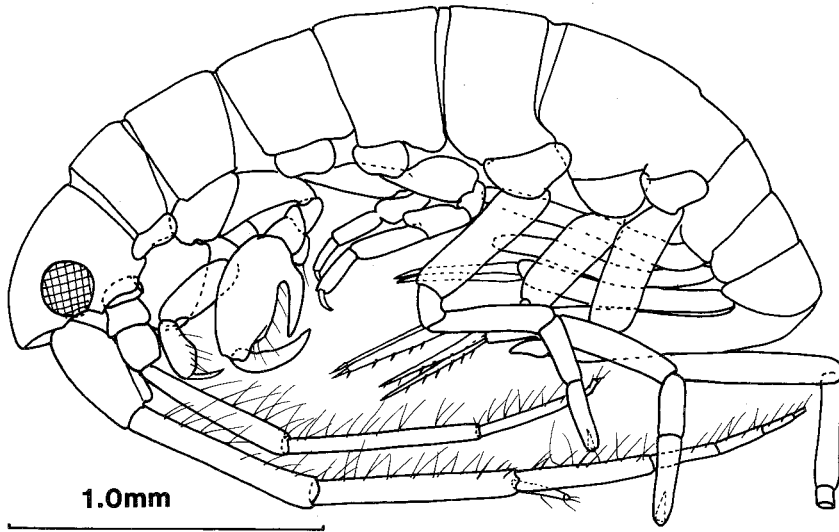


Fig. 15. *Dulichia biarticulata* sp. nov. Holotype, male, 4.9 mm.

1-3 and flagellum article 1 6:10:10:7; accessory flagellum 2-articulate, ultimate article rudimentary; main flagellum 4-articulate, each article with distal spine, ventral margin of proximal article bearing many aesthetascs. Antenna 2 shorter than antenna 1; gland cone medium in gammarids; length ratio of peduncular articles 4-5 and flagellum article 1 6:7:4; flagellum 2-articulate, ultimate article with pair of spines apically.

Mouthparts. Upper lip as usual in *Dulichia*. Outer plate of lower lip ornamented with row of several flattened processes on medial side of shoulders. Both mandibles similar except for lacinia mobilis and number of accessory teeth; incisor 5-dentate; lacinia mobilis in left mandible 4-dentate and in right mandible minutely bifid (never pectinate), accessory teeth 4 (left) and 3 (right); molar process developed, with seta; palp 3-articulate, penultimate article about twice the length of ultimate article, with 2 rows of pinnate setae, ultimate article with 3 medial and 3 distal setae, setae stiff and dispersively pinnate. Maxilla 1, inner plate reduced, naked; outer plate with 9 teeth, greater part of them bifid; palp 2-articulate, with 4 conical teeth apically. Inner plate of maxilla 2 with facial row of 10 setae. Maxilliped, inner plate with 3 conical teeth; outer plate with 3 stout facial spines and several setae medially; palp 4-articulate, ultimate article 2/3 the length of penultimate article, stout, obliquely truncate, with 2 distal spines.

Gnathopods. Gnathopod 1 simple; posterior margin of propodus not rounded, grasping margin of dactyl finely pectinate. Gnathopod 2 subchelate, robust; basal prominent projection of propodus extending nearly along palm, palm not concave; dactyl slightly reaching position beyond base of palmar basal projection when closed, with several small tuberosities laterally, grasping margin smooth.

Pereopods. Pereopods 3-4 similar except for basis, less hairy than those of the

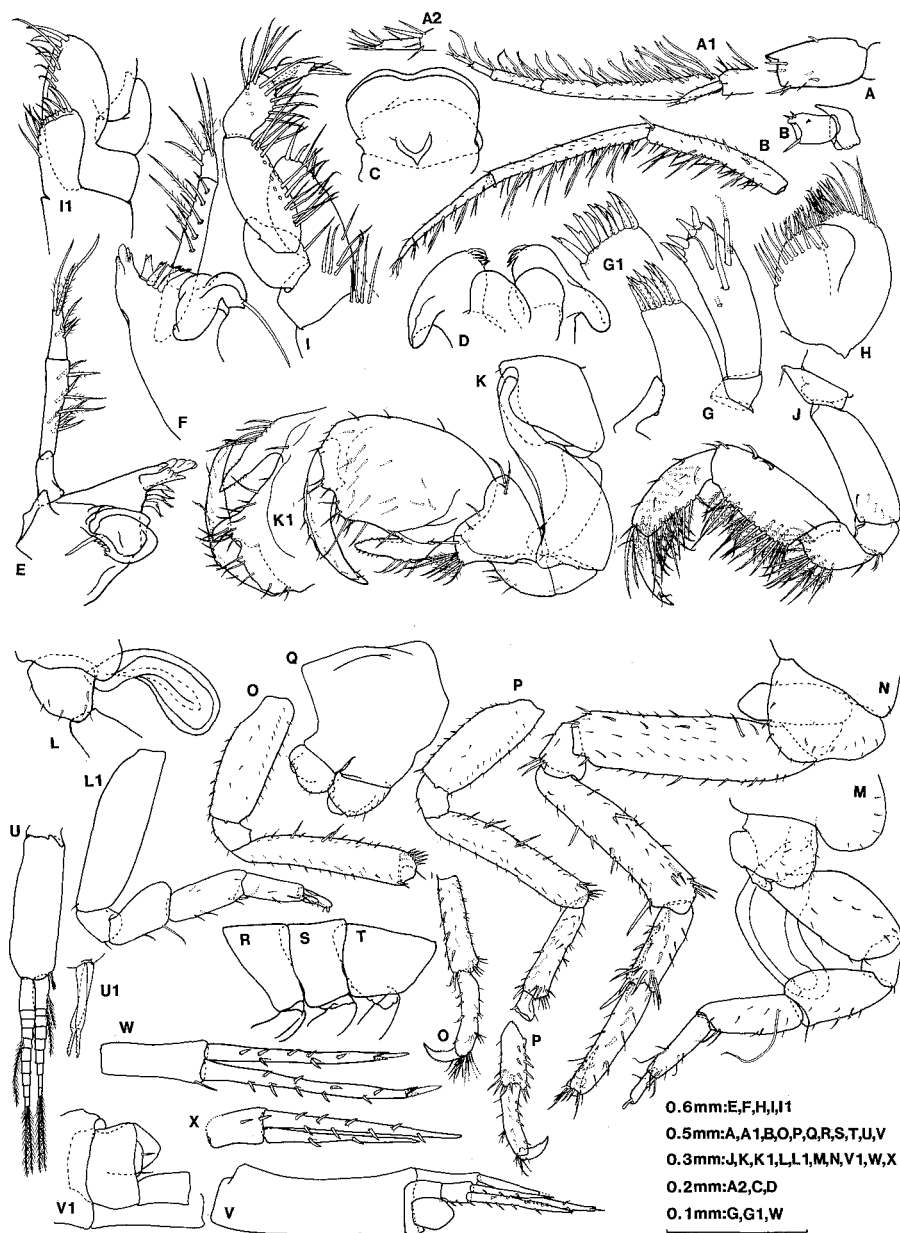


Fig. 16. *Dulichia biarticulata* sp. nov. Holotype, male, 4.9 mm. A: Peduncular article 1 of antenna 1. A1: Accessory flagellum and flagellum of antenna 1. A2: Terminal article of flagellum in antenna 1. B: Antenna 2. C: Upper lip. D: Lower lip. E: Left mandible. F: Right mandible. G: Maxilla 1. G1: Outer plate of maxilla 1. H: Maxilla 2. I: Palp and outer plate of maxilliped. I1: Inner and outer plates of maxilliped. J: Gnathopod 1. K: Gnathopod 2. K1: Dactyl and palm of propodus in gnathopod 2. L and L1: Pereopod 3. M: Pereopod 4. N: Pereopod 5. O: Pereopod 6. P: Pereopod 7. Q: Pereonites 6-7. R: Pleonite 1. S: Pleonite 2. T: Pleonite 3. U: Pleopod 1. U1: Coupling spines of pleopod 1. V: Urosome and telson in dorsal view. V1: Urosomite 2 in ventral view. W: Uropod 1. X: Uropod 2.

other *Dulichia* spp., articles not tremendously elongate, rather stout; basis in pereopod 3 slender, in pereopod 4 gradually expanding backward, stout; dactyl with blunt tooth distally. Pereopods 5-7 comparatively similar; in pereopods 5 and 7, propodi clearly longer than carpi.

Pleopods. Similar, elongate; peduncle of pleopod 1 shorter than urosome 1, distal part of coupling spines slender and serrate; rami shorter than peduncle, terminal swimming setae longer than 1/2 the rami.

Uropods. Uropod 1, peduncle with medio-distal spine; rami slender, with triangular extension and 2 spines distally, one spine large; length ratio of peduncle, and inner and outer rami 9:17:14. Uropod 2, peduncle, and inner and outer rami approximately 5:17:13 in length ratio, peduncle with 2 latero-distal spines; rami styliform. Uropod 3 absent.

Telson. Semiovate, small.

Remarks

The family Podoceridae has been reviewed and revised by Laubitz (1977, 1979, 1983). Eleven genera were divided into four subfamilies, Podocerinae, Xenodicinae, Neoxenodicinae and Dulichiinae (Laubitz, 1983).

The present species has the following generic characters: 1) the gills are present on pereonites 2-5; 2) the pereopods 5-7 lack a propodal palm; 3) the palp of maxilliped has a stout, short terminal article which is not acute distally. These characteristics indicate that the present species should belong to the genus *Dulichia* of the subfamily Dulichiinae (Laubitz, 1977, 1983). However, the present species has characters that do not conform to the genus description; 1) the accessory flagellum of the genus *Dulichia* is 3-articulate, while that of the present species is 2-articulate; 2) the outer plate of the maxilliped in *Dulichia* usually bears many slender spines, but the present species has only 3 medial spines and several setae, like that of *D. rhabdoplastis* McClosky, 1970 (see also Laubitz, 1977) and *D. wolffi* Laubitz, 1977 which has 6 to 8 medial spines; 3) the bases of pereopods 3-4 in *Dulichia* are not expanded and are rather slender, but in the present species only the basis of pereopod 4 gradually expands backward and is stout. Of these discrepancies, we think, the 3rd item is most important because the stout and expanding bases of pereopods 3-4 occur in the related genera, *Dyopedos* and *Paradulichia* (Laubitz, 1977). On the other hand, articulate number of the accessory flagellum (1st item) and thickness of spines on the outer plate of maxilliped (2nd item) are more likely variable in a specific and often generic level in the subfamily Dulichiinae (McClosky, 1970; Bousfield, 1973; Lincoln, 1979; Laubitz, 1977, 1983). However, we refrain from establishing a new genus because other fundamental generic diagnoses in the present species fit the genus *Dulichia*.

Five valid species have been found in the genus *Dulichia* to date (Laubitz, 1977). Of these five species, the present species is close to *D. rhabdoplastis* from the west coast of North America (McClosky, 1970; Laubitz, 1977) in proportion of the articles of pereopod 7 (i.e. the basis comparatively shortened; the carpus not longer than the propodus), and the basal palmar projection on the propodus of gnathopod 2 not

gradually but remarkably extending backward.

Family SYNOPIIDAE Dana

Genus *Tiron* Liljeborg

***Tiron spiniferus* (Stimpson, 1853)**

(Figs. 17–18)

Tiron spiniferus (Stimpson, 1853): Shoemaker 1955, pp. 38–39; J. L. Barnard, 1972a, p. 86; Lincoln, 1979, p. 400.

Tiron acanthurus Liljeborg, 1865; Boeck, 1871, p. 149; Sars, 1895, pp. 399–401, pl. 140; Gurjanova, 1951, p. 591.

Material examined

Two females, nos. 1–2, 9.2 mm and 7.2 mm long, collected from Matsukawa-ura Inlet, Fukushima Prefecture, Japan, 12 February 1989, coll. Y. Oozeki and his co-workers. No. 1 specimen is mounted on glass slides in gum-chloral medium. Collection number: Asia-11.

Description of female

Body. 9.2 mm long, compressed. Head galeate, with antennal partitioning lobe. Eyes medium in gammarids, rounded; each accessory eye composed of 2 ommatidia. Pleonites 1–3 serrate postero-dorsally; pleonal epimera 1–3 with blunt tooth postero-ventrally, more or less crenulate posteriorly. Dorsal projections on urosomites 1–3 bifid distally. Gills present on pereonites 2–7.

Antennae. Antenna 1 subequal to peduncle of antenna 2 in length; accessory flagellum 4-articulate, about 1/2 the flagellum length. Peduncular article 5 of antenna 2 about 3/4 the length of penultimate article; flagellum shorter than peduncular articles 4–5 together, each article except for distal rudimentary article with 2 distal hooked spines opposite each other.

Mouthparts. Upper lip not emarginate. Mandibular process of lower lip rather small. Both mandibles similar except for lacinia mobilis; incisor 6-dentate; lacinia mobilis in left mandible 5-dentate and in right mandible 3-dentate, accessory serrate teeth 9; palp 3-articulate, slender, feeble, penultimate article with 3 marginal setae, ultimate article with 3 apical setae. Maxilla 1, inner plate with 11 pinnate setae; outer plate with 9 teeth; palp 2-articulate, with 7 teeth and submarginal row of 5 setae distally. Inner plate of maxilla 2 broader than outer plate, with facial row of 20 pinnate setae. Maxilliped, inner plate with 3 conical teeth; outer plate normal, with 6 conical naked teeth and 4 thick pinnate setae; palp 4-articulate, ultimate article awl-shaped, longer than penultimate article.

Gnathopods. Similar, simple. Basis in gnathopod 1 not strongly curved. Dactyl falcate, with tooth medially, more elongate in gnathopod 1 than in gnathopod 2. Locking spines of propodus single in gnathopod 1, paired in gnathopod 2.

Pereopods. Pereopods 3–4 homopodous except for coxae; coxa 3 triangular ventrally; dactyl normal. Pereopods 5–7 comparatively similar, dactyl normal, basis of pereopod 7 more largely winged than one of pereopod 6.

Uropods. Uropod 1 extending beyond uropod 2; in uropods 1–2, outer ramus

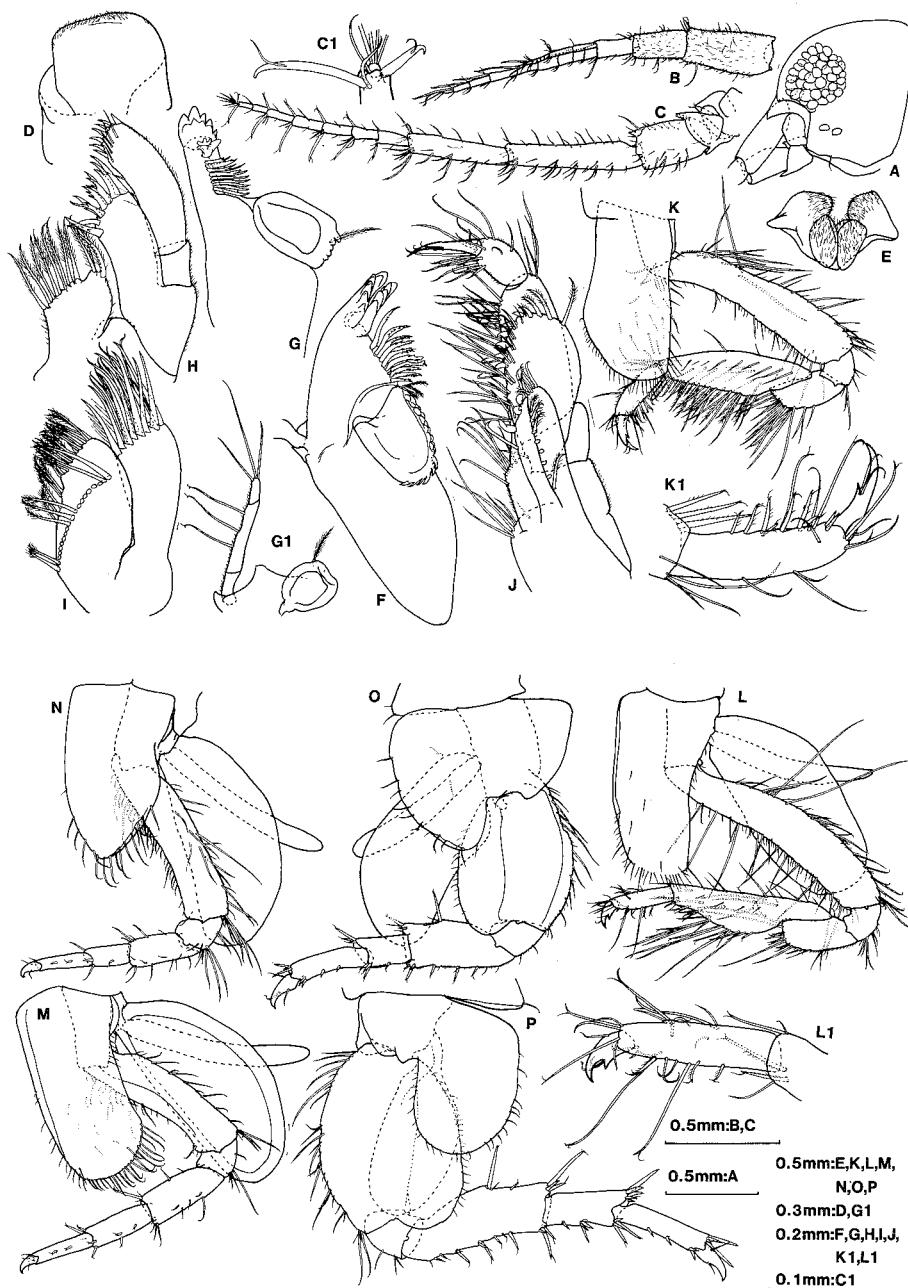


Fig. 17. *Tiron spiniferus* (Stimpson, 1853). Female (no. 1), 9.2 mm. A: Head. B: Antenna 1. C: Antenna 2. C1: Terminal article of antenna 2. D: Upper lip. E: Lower lip. F: Left mandible. G: Right mandible. G1: Palp of right mandible. H: Maxilla 1. I: Maxilla 2. J: Maxilliped. K: Gnathopod 1. K1: Propodus and dactyl of gnathopod 1. L: Gnathopod 2. L1: Propodus and dactyl of gnathopod 2. M: Pereopod 3. N: Pereopod 4. O: Pereopod 5. P: Pereopod 6.

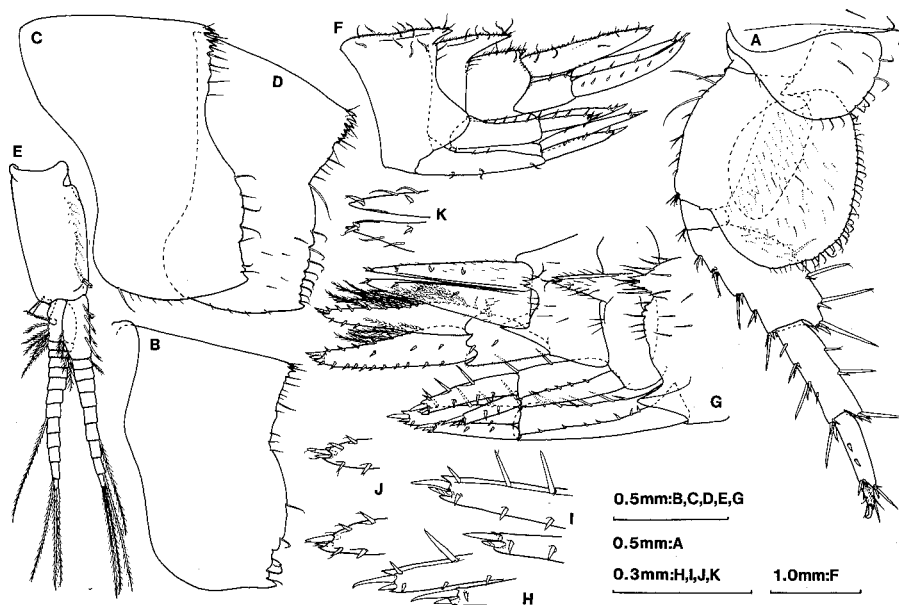


Fig. 18. *Tiron spiniferus* (Stimpson, 1853). Female (no. 1), 9.2 mm. A: Pereopod 7. B: Pleonite 1. C: Pleonite 2. D: Pleonite 3. E: Pleopod 1. F: Urosome in lateral view. G: Urosome and telson in dorsal view. H: Rami of uropod 1. I: Rami of uropod 2. J: Rami of uropod 3. K: Distal parts of telson.

shorter and more slender than inner ramus, apex of inner ramus projecting both laterally and distally, with 2 middle spines, apex of outer ramus projecting only on medial side, with 3 spines, one of them small. Uropod 3, rami equal in length, foliaceous, spinose, setose, apices projecting only on lateral side, with 2 spines.

Telson. Triangular, slender, both lobes with longitudinal row of 3 spines and apical set of 2 spines respectively.

Remarks

Tiron spiniferus (Stimpson, 1853) shows a circum-boreal distribution (J. L. Barnard, 1972a) and has been recorded from the Bering Sea, the Sea of Okhotsk and the Sea of Japan along the Russian coast of the North-East Pacific (Gurjanova, 1951; Tzvetkova, 1967; Tzvetkova & Kudrjaschov, 1985). Morphological information on this species, however, has been restricted to specimens collected from the Atlantic and the circum-boreal region. *T. acanthurus* Liljeborg, 1865 (Boeck, 1871; Sars, 1895; Gurjanova, 1951) is a synonym to the present species (Shoemaker, 1955).

The present specimens well agree with the diagnosis, description and figures of *Tiron spiniferus* given by Boeck (1871), Sars (1895), and Gurjanova (1951) and J. L. Barnard (1972a) except for several trifling discrepancies below: 1) each accessory eye is composed of two ommatidia in the present specimens, while composed of one (Sars, 1895; Gurjanova, 1951; Lincoln, 1979) or three (J. L. Barnard, 1972a) ommatidia in the previous studies; 2) the accessory flagellum of antenna 1 is 4-articulate in the

present specimens, not 5-articulate as reported in the previous studies (Sars, 1895; Gurjanova, 1951; Lincoln, 1979); 3) the telson in the present specimens bears spines in a row on each lobe, while in J. L. Barnard (1972a) and Sars (1895) it lacks spines; 4) dorsal extensions of urosomites 1–3 are bifid in the present specimens but simple distally in Sars' (1895) figure. These differences appear to be variation for this species, although we cannot perceive whether these characterize the Asian population or not.

Family AMPHILOCHIDAE Boeck

Subfamily AMPHILOCHINAE Boeck

Genus *Gitanopsis* Sars

***Gitanopsis oozekii* sp. nov.**

(Figs. 19–21)

Material examined

Holotype: female, 4.6 mm long, collected from Matsukawa-ura Inlet, Fukushima Prefecture, Japan, 12 February 1989, coll. Y. Oozeki and his co-workers. Paratype: male, 2.6 mm long, collected together with the holotype. The holotype and a part of the paratype are mounted on glass slides in gum-chloral medium. Collection number: Asia-12.

Etymology.

The specific name, *oozekii*, is in honor of Dr. Y. Oozeki who collected materials for this study.

Description of holotype (female)

Body. 4.6 mm long. Rostrum extending to distal end of peduncular article 1 of antenna 1. Eyes medium in gammarids, rounded. Pleonal epimeron 3 with blunt tooth postero-ventrally. Side plates of urosomite 3 extending nearly to distal end of telson. Gills present on pereonites 2–6.

Antennae. Short, subequal in length. Antenna 1, length ratio of peduncular articles 1–3 approximately 5:6:3; accessory flagellum 1-articulate; flagellum with aesthetascs. Peduncular articles 4–5 of antenna 2 equal in length.

Mouthparts. Upper lip asymmetrically bilobate. Shoulders of lower lip tapered apically, with 2 minute protrusions nearly at the medio-distal end; mandibular process small. Both mandibles similar except for lacinia mobilis; incisor multidentate; lacinia mobilis in right mandible absent, in left mandible broad and serrate distally; both accessory blades 13 and 15, gradually diminishing to basal one, dentate distally; molar process medium; palp 3-articulate, ultimate article 1.4 times the length of penultimate article, attenuate. Maxilla 1, inner plate with apico-medial seta; outer plate with 7 teeth and 5 spines; palp 2-articulate, with 3 spatulate teeth and 3 setae distally. Maxilla 2, inner plate larger than outer plate, with 8 setae; outer plate with 4 setae. Maxilliped, inner plate with 3 small teeth; outer plate less setose, with tooth medio-distally; palp 4-articulate, two proximal articles broad, ultimate article shorter than penultimate article.

Gnathopods. Gnathopod 1, greater part of coxa 1 concealed under coxa 2; carpal

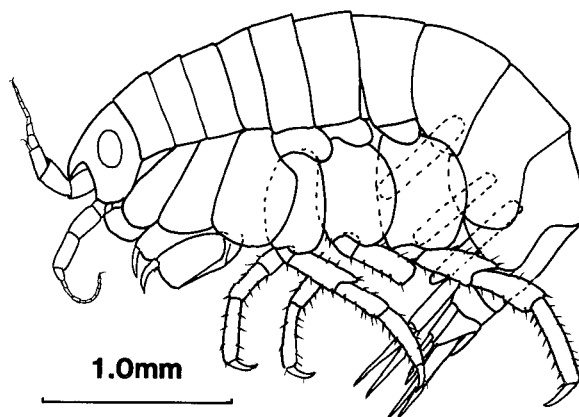


Fig. 19. *Gitanopsis oozekii* sp. nov. Holotype, female, 4.6 mm.

lobe extending to $\frac{2}{3}$ the posterior length of propodus; palm transverse, slightly convex, finely serrate, with 1 antero-distal and 2 palmar defining spines; dactyl hairy on grasping margin from base to small tooth. Gnathopod 2, basis prominently protruding postero-distally; merus with posterodistal spine; carpal lobe extending to palmar defining spines, with antero-distal spine; propodus with 2 palmar defining and 2 antero-medial spines; grasping margin of dactyl serrate.

Pereopods. Pereopods 3–4 homopodous except for coxae; posterior concavity of coxa 4 shallow, rectangular. Pereopods 5–7 homopodous except for coxae; hind lobe of bases subequal to muscular part in width, round posteriorly.

Pleopods. Pleopod 1, peduncle stout, about $\frac{2}{3}$ as long as outer ramus; terminal swimming setae short.

Uropods. Uropod 1 not extending beyond uropod 3; peduncle longer than inner ramus, spinose along lateral margin; rami lanceolate, inner ramus longer than outer ramus. Uropod 2, peduncle longer than inner ramus, outer ramus $\frac{5}{8}$ the length of inner ramus. Uropod 3 slightly shorter than uropod 1; peduncle $\frac{5}{4}$ as long as inner ramus; inner ramus longer than outer ramus.

Telson. Semioval, basal width $\frac{3}{4}$ the length.

Description of male

Paratype no. 1, 2.6 mm long (immature?). Gnathopod 1 similar to that of female except grasping margin finely serrate. Gnathopod 2 similar to that of female except carpus lobe not reaching palmar defining spines.

Remarks

The present species is closely similar to *Gitanopsis baciroa* J. L. Barnard, 1979 from the Gulf of California and Galapagos Islands (J. L. Barnard, 1979) and the Japanese gitanopsids (Hirayama, 1983), *G. brevicula* Hirayama, 1983, *G. japonica* Hirayama, 1983, *G. robustodentes* Hirayama, 1983 and *G. longa* Hirayama, 1983, in the following

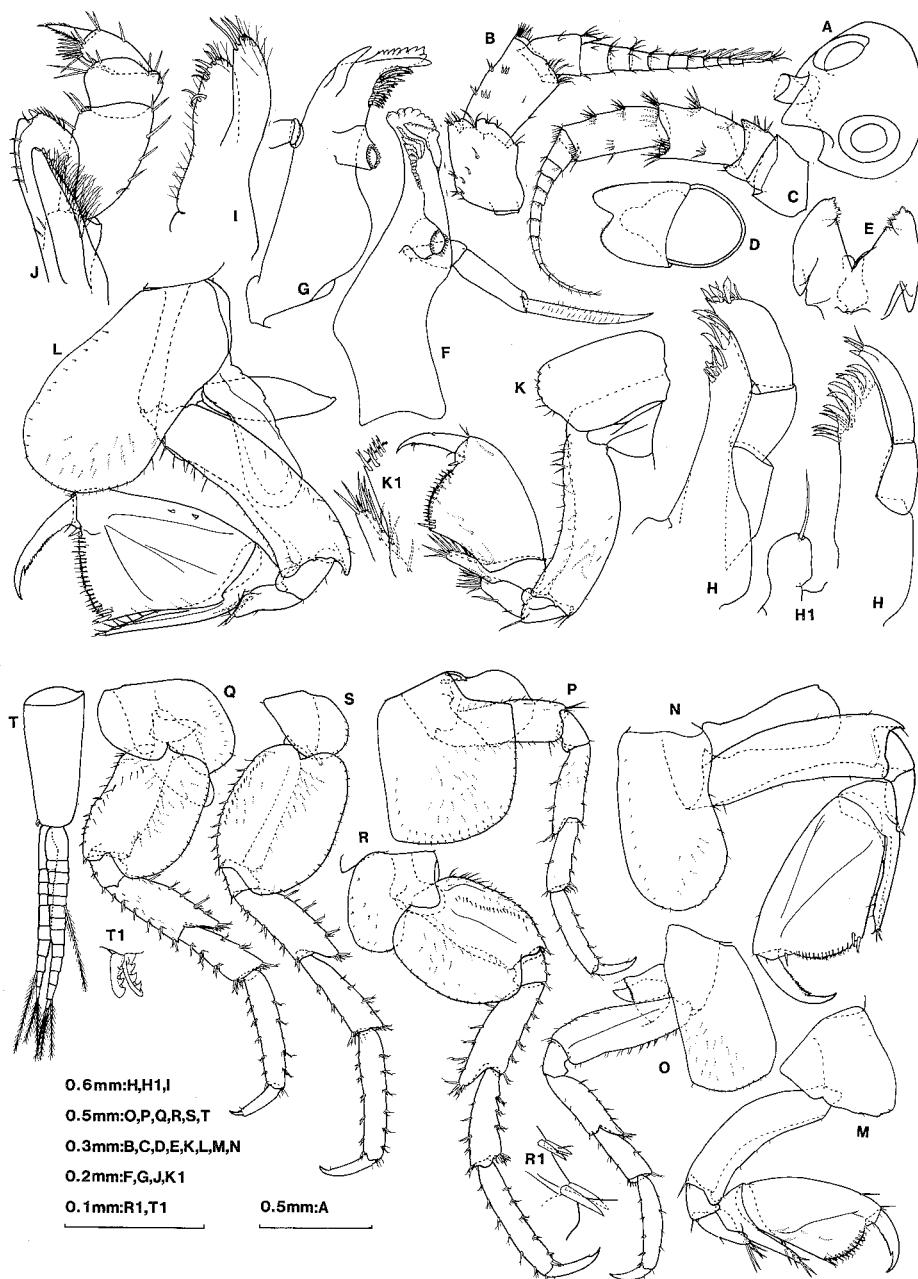


Fig. 20. *Gitanopsis oozekii* sp. nov. Holotype, female, 4.6 mm; A, B, C, D, E, F, G, H, H1, I, J, K, K1, L, O, P, Q, R, R1, S, T and T1. Paratype no. 1, male (? immature), 2.6 mm; M and N. A: Head. B: Antenna 1. C: Antenna 2. D: Upper lip. E: Lower lip. F: Left mandible. G: Right mandible. H: Maxilla 1. H1: Inner plate of maxilla 1. I: Maxilla 2. J: Maxilliped. K: Female gnathopod 1. K1: Carpal lobe of female gnathopod 1. L: Female gnathopod 2. M: Male gnathopod 1. N: Male gnathopod 2. O: Pereopod 3. P: Pereopod 4. Q: Pereopod 5. R: Pereopod 6. R1: Locking spines of pereopod 6. S: Pereopod 7. T: Pleopod 1. T1: Coupling spines of pleopod 1.

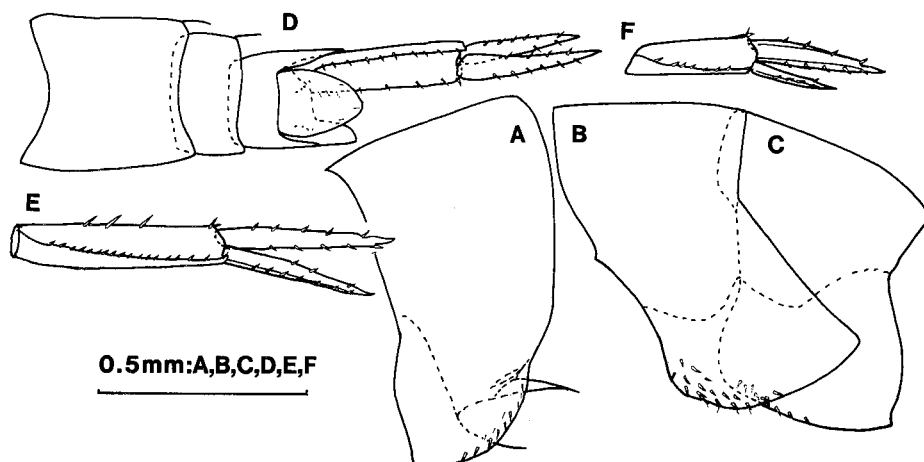


Fig. 21. *Gitanopsis oozeckii* sp. nov. Holotype, female, 4.6 mm. A: Pleonite 1. B: Pleonite 2. C: Pleonite 3. D: Urosome, uropod 3 and telson. E: Uropod 1. F: Uropod 2.

characteristics: 1) the rostrum reaches the distal end of the peduncular article 1 of antenna 1; 2) the inner plate of maxilla 2 has ca. 10 distal setae; 3) the molar process of the mandible is medium (compare the counterpart of *G. pele* J. L. Barnard, 1970 (see also Ledoyer, 1982a) and *G. kupe* J. L. Barnard, 1972 (J. L. Barnard, 1972b)); 4) the carpus lobe of gnathopod 2 nearly or just reaches the palmar defining spines.

Of the above five species, the shape of the telson, of which the length is equal to or a little shorter than twice the basal width, indicates that the present species is more closely related to *Gitanopsis baciroa* and *G. brevicula* than to the other three species. The other three species have a rather elongate telson. The basis of gnathopod 2 in *G. baciroa* and *G. brevicula* does not extend postero-distally, but in the present species the basis is prominently extended posterodistally. Thus, the present species is clearly distinguished from these two species in the feature of gnathopod 2. On the other hand, *G. robustodentes* and *G. longa* have posterodistal extensions of the basis; in *G. longa* the extension is short, and *G. japonica* lacks the posterodistal extension. However, *G. japonica* and *G. longa* have a spine on a posterodistal angle of the basis instead of the well-developed extension.

Family STENOTHOIDAE Boeck

Genus *Stenothoe* Dana

***Stenothoe dentirama* sp. nov.**

(Figs. 22–24)

Material examined

Holotype: male, 3.2 mm long, collected from Matsukawa-ura Inlet, Fukushima Prefecture, Japan, 12 February 1989, coll. Y. Oozeki and his co-workers. Paratype: female, about 2.5 mm long, collected together with the holotype. The holotype and a part of the paratype are mounted on glass slides

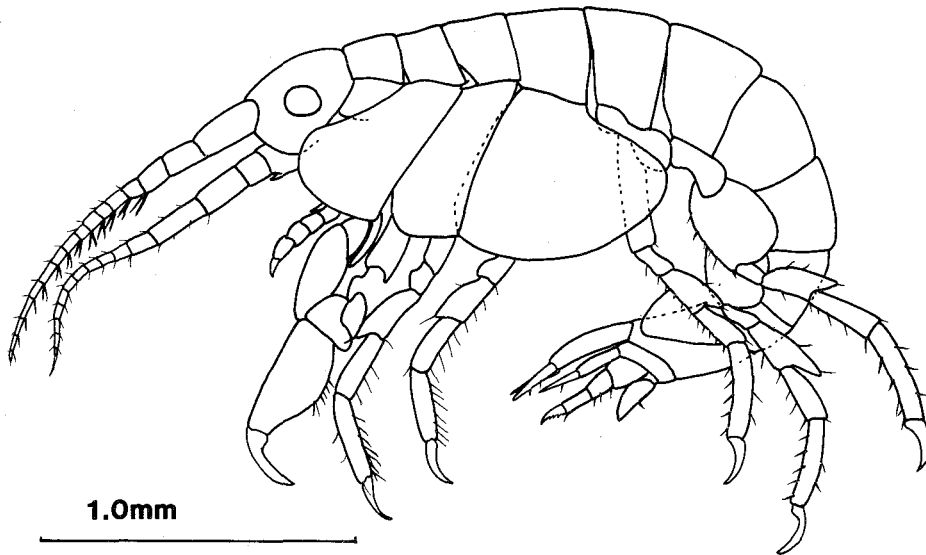


Fig. 22. *Stenothoe dentirama* sp. nov. Holotype, male, 3.2 mm.

in gum-chloral medium. Collection number: Asia-13.

Etymology

The specific name, *dentirama*, refers to the dentate ultimate article of uropod 3 in the present species.

Description of holotype (male)

Body. 3.2 mm long. Latero-cephalic lobe not extending to apex of rostrum, partitioning lobe present between both antennae 1. Pleonal epimera 1–3 extending backward, posterodistal angle of epimeron 3 blunt.

Antennae. Antenna 1, length ratio of peduncular articles 1–3 8:6:3; accessory flagellum absent; flagellum articles bearing small tubercle with single or paired aesthetascs apically. Antenna 2 not extending far beyond antenna 1; gland cone small; length ratio of peduncular articles 4–5 7:8; flagellum article 1 slightly shorter than 1/2 the length of peduncular article 5.

Mouthparts. Upper and lower lips missing (see upper lip in the paratype). Both mandible not similar, lacking palp and molar process, with 7 accessory blades, dorsal small protrusion with seta instead of palp; in one mandible (? left), incisor 5-dentate, lacinia mobilis small, 3-dentate; in the other mandible (? right), incisor and lacinia mobilis minutely multi-dentate, lacinia mobilis broad. Maxilla 1, inner plate with seta; outer plate two-tined, with 3 stout spines; palp 2-articulate, ultimate article with medial row of 5 stiff setae. Both plates of maxilla 2 reduced, coalescent basally, inner plate with 2 setae, outer plate with 3 apical setae. Maxilliped lacking outer plate; inner plate small, with 2 apical setae; basal article of endopod (ischium)

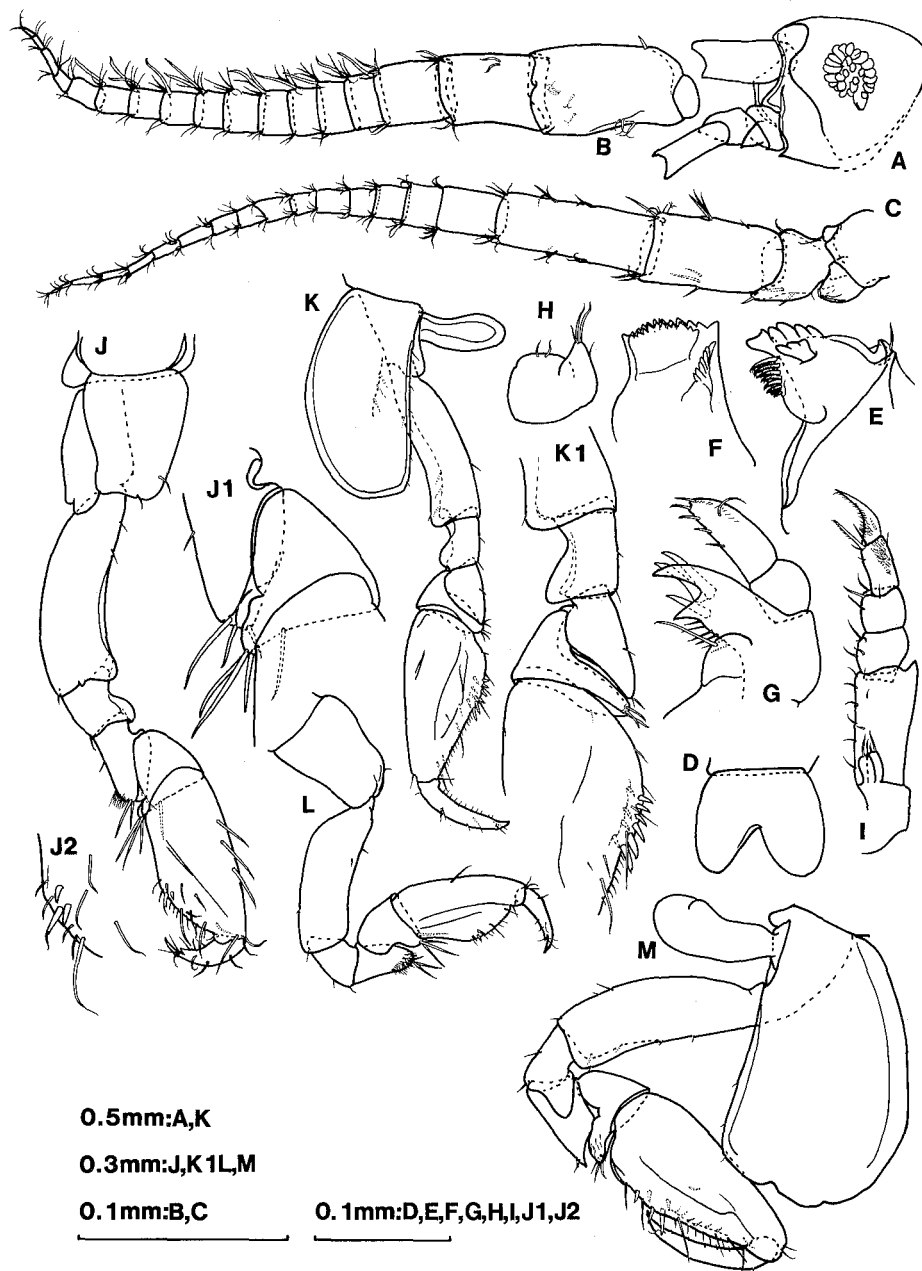


Fig. 23. *Stenothoe dentirama* sp. nov. Holotype, male, 3.2 mm; A, B, C, E, F, G, H, I, J, J1, J2 and K. Paratype no. 1, female 2.5 mm; D, L and M. A: Head. B: Antenna 1. C: Antenna 2. D: Upper lip. E: One mandible (? right). F: The other mandible (? left). G: Maxilla 1. H: Maxilla 2. I: Maxilliped. J: Male gnathopod 1. J1 and J2: Carpus and palm of male gnathopod 1. K: Male gnathopod 2. K1: Ischium, merus and carpus in male gnathopod 2. L: Female gnathopod 1. M: Female gnathopod 2.

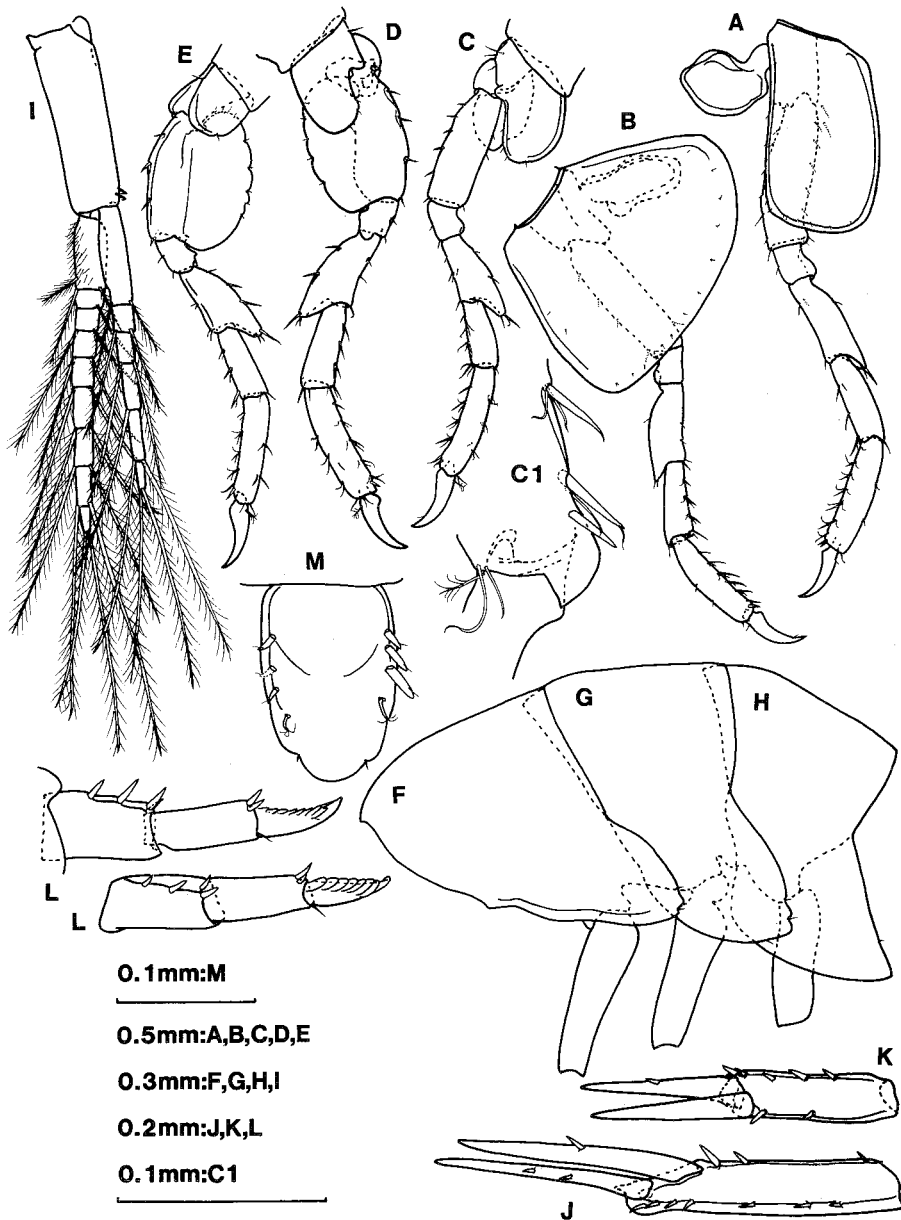


Fig. 24. *Stenothoe dentirama* sp. nov. Holotype, male, 3.2 mm. A: Pereopod 3. B: Pereopod 4. C: Pereopod 5. C1: Locking spines of pereopod 5. D: Pereopod 6. E: Pereopod 7. F: Pleonite 1. G: Pleonite 2. H: Pleonite 3. I: Pleopod 1. J: Uropod 1. K: Uropod 2. L: Uropod 3. M: Telson.

projecting latero-distally; palp 4-articulate, penultimate article shorter than ultimate, with thick hairy seta medio-distally.

Gnathopods. Gnathopod 1 subchelate, smaller than gnathopod 2; coxa 1 reduced, almost concealed by coxa 2, merus not elongate, pubescent postero-distally; carpus subequal to ischium in length, posterior lobe not developed, with 3 thick setae distally; propodus about $3/4$ the basis length, uniform in width, palm oblique, smooth, defined by 3 spines; dactyl with small tooth on almost distal end of grasping margin. Gnathopod 2, coxa continuously rounded both anteriorly and ventrally; propodus a little longer than basis, most expanded on base, palm almost parallel to longitudinal axis, smooth, defined by small expansion at point of about $1/2$ the posterior length, expansion with 2 rows of spines.

Pereopods. Pereopods 3–4 similar except for coxae; coxae 3–4 well developed, coxa 3 rectangular, coxa 4 broad, gradually expanding backward and not concave posteriorly; posterior length ratio of articles from basis to dactyl almost 8:2:5:5:6:3; propodus with single locking spine. Pereopod 5 comparatively similar to pereopod 4 except for coxa, basis lacking hind lobe. Pereopods 6–7 similar except for coxae; coxa 6 similar to coxa 5, coxa 7 unilobate, small; basis expanding backward, hind lobes minutely crenulate posteriorly; articles from ischium to dactyl similar to those of pereopod 5.

Pleopods. Pleopod 1 slender; peduncle longer than $1/2$ the length of outer ramus; inner ramus $8/9$ the length of outer ramus, 6-articulate; outer ramus 9-articulate; terminal swimming setae shorter than inner ramus.

Uropods. Uropod 1 equiramous, peduncle extended backward ventrally; inner ramus with medial spine; outer ramus with 2 middle spines. Uropod 2 equiramous, peduncle equal to rami in length; outer ramus with 1 or 2 middle spines, inner ramus lacking spines. Uropod 3 uniramous, ramus 2-articulate, length ratio of peduncle and two articles of ramus 6:6:5, peduncle with 3 lateral and 1 medio-distal spines; proximal article of ramus with pair of spines distally, ultimate article dentate dorsally.

Telson. Gently rounded and produced distally, never tapered, lateral margins with row of 3 spines, slightly notched subdistally.

Description of female

Paratype no. 1, 2.5 mm long. Gnathopods 1–2 similar to those of male. Upper lip symmetrically bilobate.

Remarks

The present species has discriminative characteristics in the telson and uropod 3 from the other species of *Stenothoe*. All species of *Stenothoe* except for *S. minuta* (Holmes, 1905) (see Bousfield, 1973) have a more or less tapering telson, which is often acuminate and/or aristiate (Sars, 1882, 1895; Stebbing, 1888; Della Valle, 1893; Chevreux, 1900, 1908, 1935; Holmes, 1904; K. H. Barnard, 1916; Chevreux & Fage, 1925; Stephensen, 1927, 1931, 1949; Schellenberg, 1931; Reid, 1951; Dunbar, 1954; Shoemaker, 1955, 1956; Mateus & Mateus, 1966; J. L. Barnard, 1970, 1972b, 1974; Bousfield, 1973; Krapp-Schickel, 1976; Bynum & Fox, 1977; Ledoyer, 1979, 1986; Lincoln, 1979; Myers & McGrath, 1980; Myers, 1985). Both lateral margins of the

telson in *S. minuta* are smooth and are provided with a pair of spines. On the other hand, the telson of the present species is gently round and never taped, and both lateral margins are slightly notched distally and bear 3 pairs of spines. The uropod 3 of the present species is 6:6:5 in segmental proportion and is remarkably dentate on the ultimate article. In other species of *Stenothoe* so far as known, the peduncular article of uropod 3 is clearly longer than the proximal and ultimate articles of the ramus or shorter, and is often longer than the ramus itself. Further, the dentate feature on the ultimate article of the ramus has been noticed only in *S. estacola* J. L. Barnard, 1962 to date although it have been overlooked in other species. This dentate condition of the present species is, however, more deeply sculptured than in *S. estacola*.

In *Stenothoe barrowensis* Shoemaker, 1955 and *S. setosa* Norman, 1900 (Lincoln, 1979), the telson and uropod 3 have not been clearly described. Additionally, in *S. kaia* Myers, 1985, *S. moe* J. L. Barnard, 1972b, *S. stephensi* Reid, 1951, and *S. uncinifera* Mateus & Mateus, 1966, the telson has not been described and figured. However, the propodus of gnathopod 2, especially in males of the present species differs from that of other stenothoid species by following ways. The palm of the propodus of the present species is subovate and not expanded proximally, and the palm is smooth. The palm of the propodus of male *S. setosa* and male *S. kaia* is longitudinal and convex, and in male *S. barrowensis* and female *S. stephensi* oblique, not convex, and the grasping margin in both sexes is not smooth. Moreover, the propodus of male *S. moe* is more elongate than that of the present species and is nearly ovate.

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